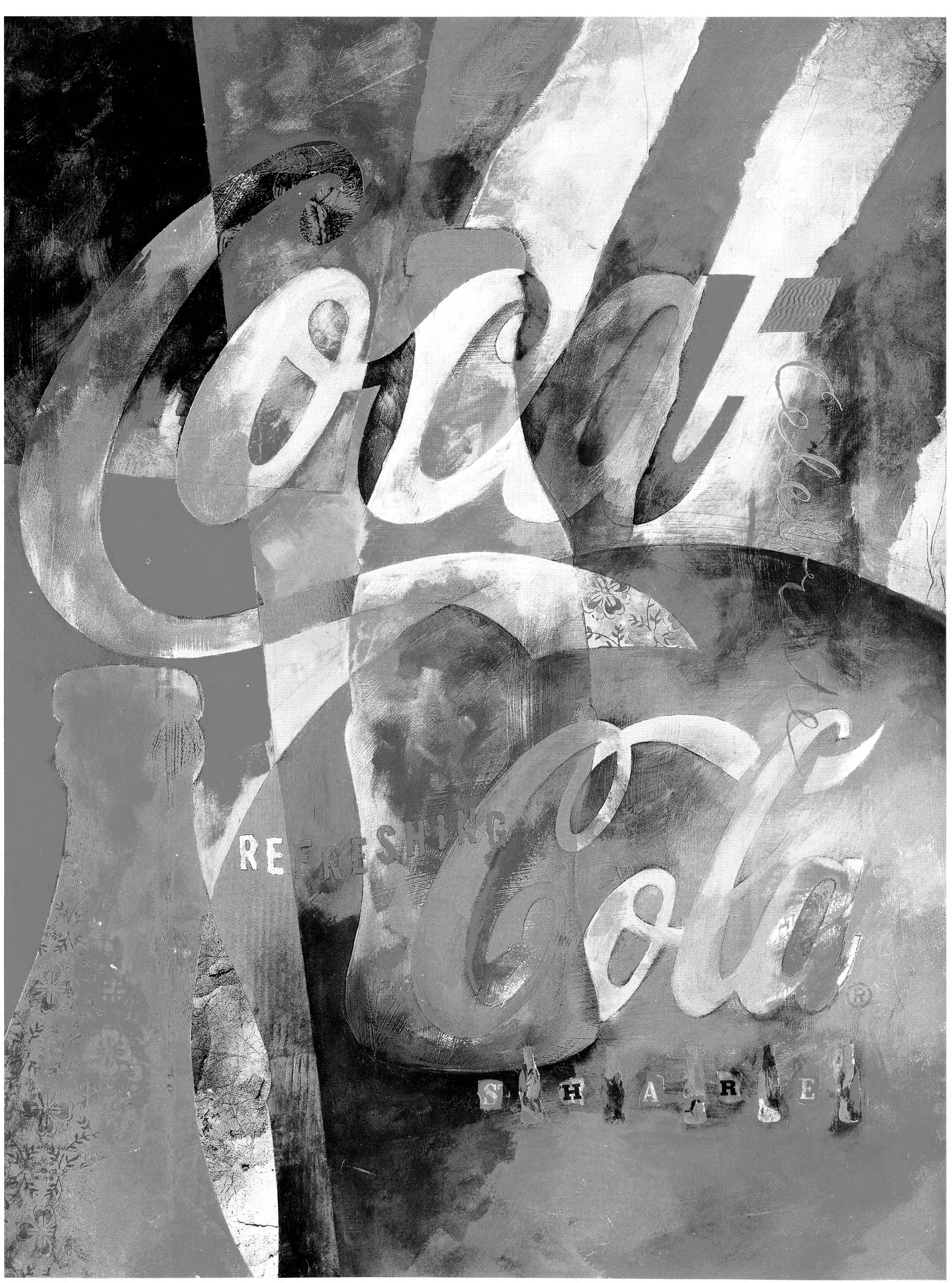


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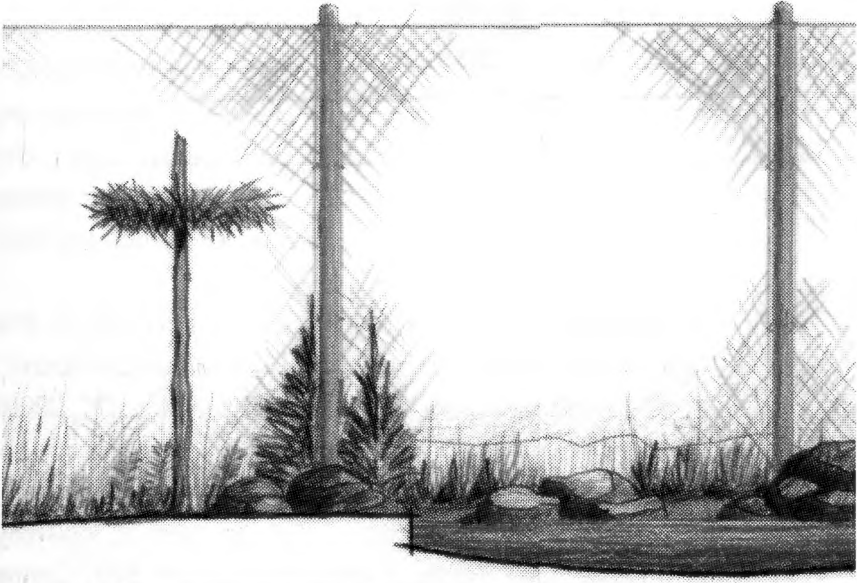
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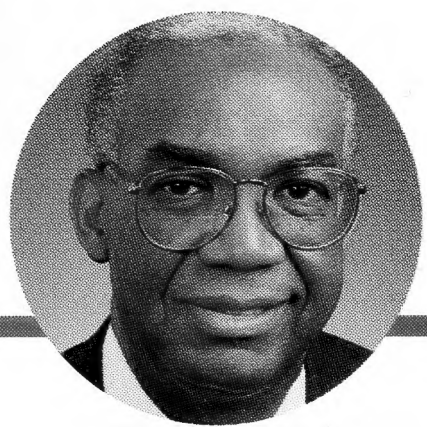
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FONZ FORUM

MY DEPARTURE

On May 15, I enjoyed leading FONZ's 20th annual National ZooFari gala, another glorious evening at the National Zoo despite the light rain. Sadly that was my last ZooFari as Executive Director of FONZ. I will be 65 this summer and plan to retire in the fall. I first attended a ZooFari in 1988, having recently joined FONZ as Deputy Executive Director. I saw that night FONZ's enormous potential for greatness in the energy, enthusiasm, and commitment of people—staff and volunteers—working at the National Zoo. I looked forward to bringing to FONZ the leadership and management skills I had acquired in my first career in the U.S. Army.


I have now been Executive Director since 1989 and I believe I am leaving an organization that has realized at least some of the greatness I envisioned more than 15 years ago, and one poised to do even more to achieve our mission to support the Smithsonian's National Zoo in celebrating, studying, and protecting wildlife and their habitats. The FONZ Board of Directors is conducting a national search for my replacement. I am confident that the candidate they select will lead FONZ into this still-greater future, with the support of a very talented FONZ staff that has made FONZ into what I define as a truly "magical" organization.

I will leave with much sadness. Working at the Zoo has been an incredible experience: always challenging but always fun too. It's been a privilege to have the beautiful Zoo as my office, with daily opportunities to see interesting animals doing interesting things and hard to image not coming here everyday. In my time here, I've witnessed the birth of two elephants and several giraffes, delighted in the antics of tiger cubs, welcomed giant pandas Tian Tian and Mei Xiang to the Zoo, and much more. When I started, I knew almost nothing about wildlife and the urgency of conserving it. Learning about this, I quickly became deeply committed to this cause and to educating people about its importance. I am as moved today as I was in 1987 to see the expressions of delight and wonderment on the faces of kids seeing for the first time a lion, or an octopus, or a gorilla, or any of the Zoo's marvelous animals.

What do I plan to do next? I sometimes say jokingly that I'm going to help my uncle—my uncle who does nothing at all. I do hope to spend a little more time relaxing; leading FONZ has been a 24/7 job. Speaking seriously, however, I can report that I will be joining a group of my favorite people, FONZ corps of volunteers, as a member of the National Zoo's Advisory Board. I am also relishing stepping into a third career as a full-time husband, father, and, especially, doting grandfather. I hope that one day, when my four-year-old grandson is my age, he will see Asian elephants in the wilds of India, or cheetahs on the African savanna, or black-footed ferrets on the American great plains—and know that his granddad helped to make such an experience possible.

I am grateful to the many men and women who have served on the FONZ Board of Directors, on my staff, and on the staff of the National Zoo during my tenure here. We have been a remarkable team and it has been a pleasure to work and be friends with all of them. And I am grateful to all of the FONZ members and volunteers whose generous support I have experienced for so long. I hope I see all of you often when I am truly one the Zoo's very important people—a visitor enjoying a great day at our Nation's zoo.

Sincerely,


Clinton A. Fields
Executive Director

Friends of the National



is a non-profit organization dedicated to supporting the conservation, education, and research efforts of the Smithsonian's National Zoo. Formed in 1958, FONZ was one of the first conservation organizations

in the nation's capital. Friends of the National Zoo is dedicated to supporting the Smithsonian's National Zoo in a joint mission to study, celebrate, and help protect the diversity of animals and their habitats.

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Membership in FONZ offers many benefits: publications, discounts on shopping, programs, and events, free parking, and invitations to special programs and activities to make zoogoing more enjoyable and educational. To join, write FONZ Membership, National Zoological Park, Washington, DC 20008, call 202.673.4961 or go to www.fonz.org.

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Individual	\$39
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Photo by John & Karen Hollingsworth / Three Black Ducks.

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LETTER FROM THE ZOO DIRECTOR

Dear ZooGoer:

I will always remember my first close-up encounter with a bald eagle. Everything about her was gorgeous, from the white feathers on her head to her yellow feet with sharp talons. I was in awe of this great bird. But she could not fly; she had injured her right wing flying into a power line. An expert handler restrained her for a physical examination. It takes just the right amount of restraint—firm but gentle—to hold one of these great birds without undue stress. With her head draped in a soft cloth for a blindfold and her strong legs held firmly, she remained nearly perfectly still for her exam. She was lucky: Her injury was a mild muscle tear and she recovered after a few weeks of supportive care and physical therapy. When she flew away, the sight nearly took my breath away.

We hear often of habitat loss, and the various threats to endangered species, such as the bald eagle. Something as simple as a power line can pose a threat to this great bird. Fortunately, there are efforts underway to restore habitats and protect endangered species, and to educate the public about the importance of conservation. These efforts happen largely as a result of conservation partnerships, among state and federal agencies, local and city park systems, zoological parks, universities and veterinary schools, and nature centers.

The bald eagle's return from the brink of extinction is an important conservation partnership success story, and one that we share with our visitors in a new Bald Eagle Refuge exhibit opening on the 4th of July. Our nation's wildlife refuge system played a key role in this recovery effort. Administered by the Department of the Interior's U.S. Fish & Wildlife Service (USFWS), the National Wildlife Refuge (NWR) System represents a 95-million-acre network of critical habitat for threatened and endangered species.

For all of us at the National Zoo, the new Bald Eagle Refuge exhibit represents a successful partnership of its own. Two years ago, we identified that our bald eagle exhibit on the Valley Trail was in great need of renovation. While we were able to secure funding for basic repairs, we wanted to transform the exhibit so that our visitors could get closer to this awesome bird, while also learning about this conservation success story. About that same time, the NWRS was preparing to celebrate its 2003 centennial. To mark this historic year, the Smithsonian's National Zoo formed a partnership with the American Zoo and Aquarium Association (AZA) and the USFWS to secure the necessary funding to renovate the bald eagle exhibit, as well as to create educational materials about the NWRS. FONZ also contributed funds and developed the interpretive program for the exhibit. An important element in this partnership is that all of the educational materials associated with the exhibit, including the touch-screen refuge locator, will be made available to other AZA institutions and wildlife refuges across the country.

While some injured eagles make it back to the wild, many others find homes in nature centers and zoos. The two bald eagles in our Refuge were rescued and taken in at the American Eagle Foundation's Eagle Mountain Sanctuary in Tennessee. They join a variety of other North American species along the Valley Trail, including Mexican wolves, sea lions, gray seals, North America river otters, beavers, and a variety of waterfowl. The exhibit includes a 1,250-square-foot landscaped enclosure with a small pond and stream where visitors can watch the eagles from an adjacent wildlife viewing blind. The landscaping in and around the new exhibit will create a natural setting for the bald eagles, using plants native to the Washington, D.C., region. Included among the flora will be trees, shrubs, forbs, grasses, sedges, and rushes that re-create the appearance of several different types of habitat where one might find bald eagles: forest edge, moist lowland, open field, and evergreen forests.

The Refuge exhibit also includes an area for live bird demonstrations with other raptor species. Full-color graphic panels explain bald eagle biology and conservation, and a series of signs called "Conservation Connections" will explore the collaborative nature of conservation efforts and the ways zoos work with organizations, such as the USFWS, to conserve nature. Finally, visitors can activate a video theater with a program about the NWRS's 100-year history, and a touch-screen computer that displays state-by-state information on the refuges.

The Bald Eagle Refuge is but one example of National Zoo conservation partnerships. Many of our partnerships extend well beyond Washington, and many involve research. We are fortunate to have some of the best scientists in the world studying the reproductive and conservation biology of endangered species that live in our refuge system, including migratory birds and black-footed ferrets. Outside the United States, we are studying other eagles, and also in partnership. Working with the Center of Studies on Iberian Raptors in Spain, National Zoo Department of Reproductive Sciences post-doctoral fellow, Juan Manuel Blanco, has recently produced golden eagles and Bonelli's eagles by artificial insemination. The next step is to extend this work to the Spanish imperial eagle, a species that is on the brink of extinction.

Please come join us in celebrating our conservation partnerships and our national bird at the National Zoo.



Lucy H. Spelman
Director

Smithsonian's National Zoological Park

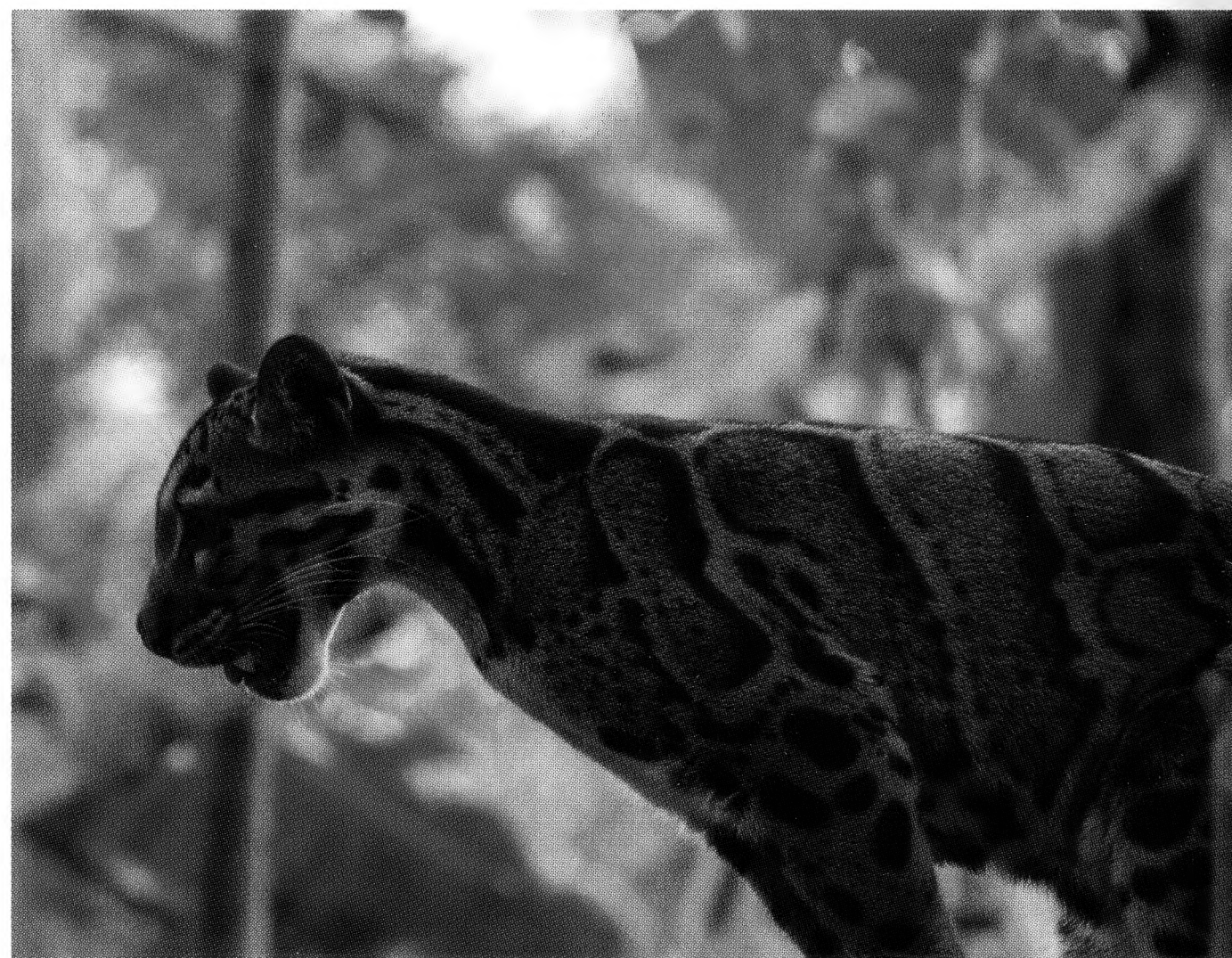
>>ANIMAL NEWS

On April 23, the Smithsonian's National Zoo's Masai giraffe Jana made the road trip from Washington to Boston, relocating at the Franklin Park Zoo. This was done in cooperation with the American Zoo and Aquarium Association's Species Survival Plan for the Masai giraffe (*Giraffe camilopardalis trippelskirchi*). The zoological equivalent of the Dating Game, the SSP allows genetic management of zoo populations, ensuring genetic diversity and viability. So, with the help of her friends and keepers at the Zoo, Jana

headed off to Beantown to meet her future mate.

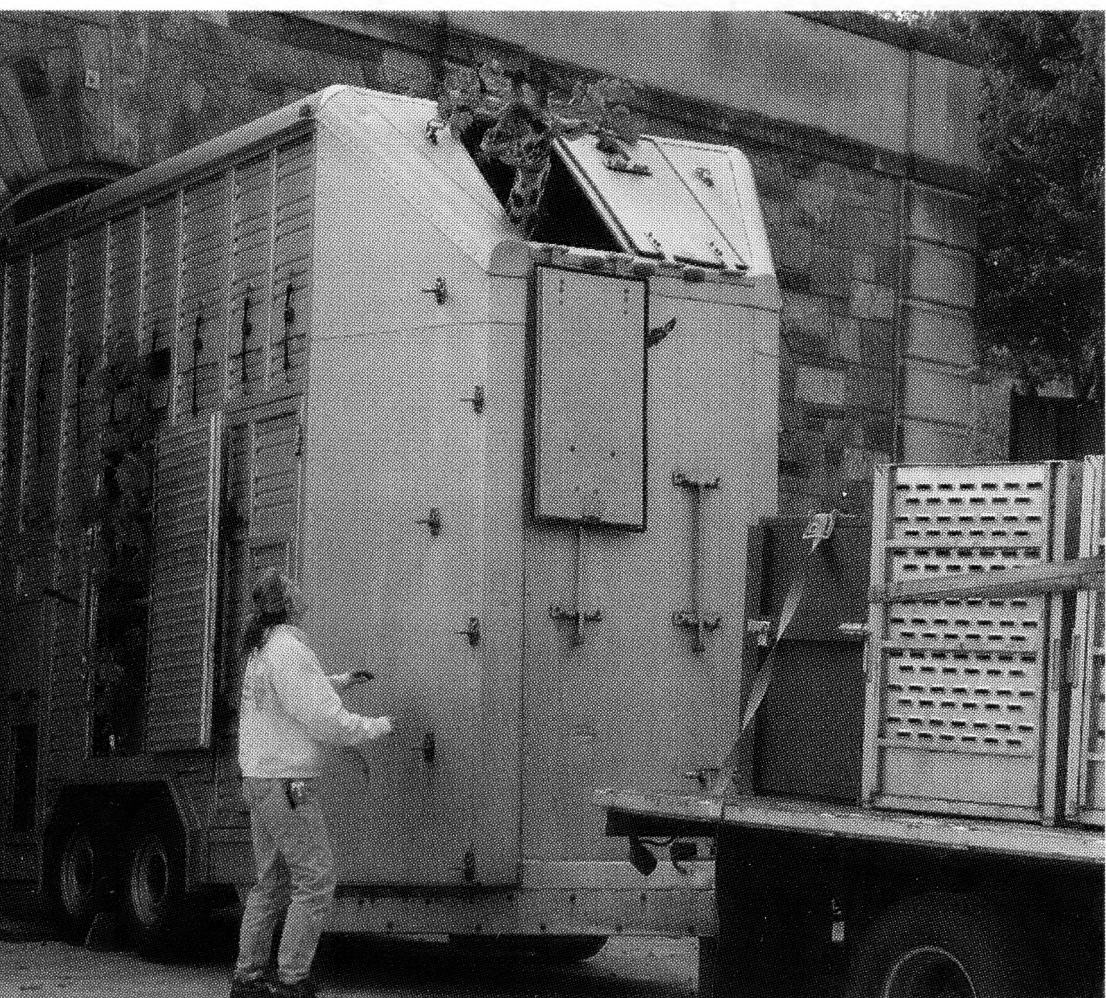
Jana's old housemate Malaika—a two-year-old, 12-foot-tall, female reticulated giraffe (*Giraffe camilopardalis reticulata*)—will have her Elephant House digs to herself until another giraffe can be found to join her.

A pair of cygnets was born to the Zoo's trumpeter swans (*Cygnus buccinator*) this spring. The trumpeter swan is the largest waterfowl in North America and the largest swan in the world, with a wingspan that can reach eight feet across. In the wild, the pen (female) lays one egg every other day until she has a full clutch of three to nine eggs, which she incubates for an average of 35 days; the cob (male) defends the nest against intruders or predators. When they hatch, the cygnets are able to swim immediately, but usually stay in the nest for 24 hours.



CLOUDED LEOPARD.

Zoo reproductive scientist JoGayle Howard received good news from the on-site project leader of the Thailand Clouded Leopard Breeding Program at Khao Kheow Open Zoo. The first litter of clouded leopard (*Neofelis nebulosa*) cubs was born in this cooperative project with the Khao Kheow Open Zoo on April 22. The success confirms that the improved diet, husbandry, and enclosures are sufficient for clouded leopard reproduction.



JANA THE ROAD-TRIPPING GIRAFFE.

>>LATE SUMMER FUN

Stay up to date with our Sunset Serenades outdoor concerts, which run Thursdays from July 3 through August 14. The live music starts at 6:30 p.m. on the Zoo's Lion/Tiger Hill and wraps up at 8:30 p.m. So bring a friend and a picnic (Zoo concessions are also open) and enjoy the cool sounds of jazz, blues, rock/pop, reggae, rock-and-roll revival, and patriotic music and marches. The latest schedule is at <http://nationalzoo.si.edu>. Admission is free.

For FONZ Young Professional members, we have YP After-Hours

events that will be held August 21, "Won't You Take Me To... Monkey Town," (a disco theme), and September 18, "I Get a Kick Out of Shrew," (with big-band music and fox-trot lessons). Tickets are \$8 at the door for FONZ YP members and \$10 for nonmembers. Food and snacks from a local restaurant are included, and there is a cash bar. Guests can receive a discount by ordering tickets by 2:00 p.m. the day of the event.

>>VOLUNTEER CORNER

The Volunteer Association at the National Zoo (VANZ) is an educational and social organization open

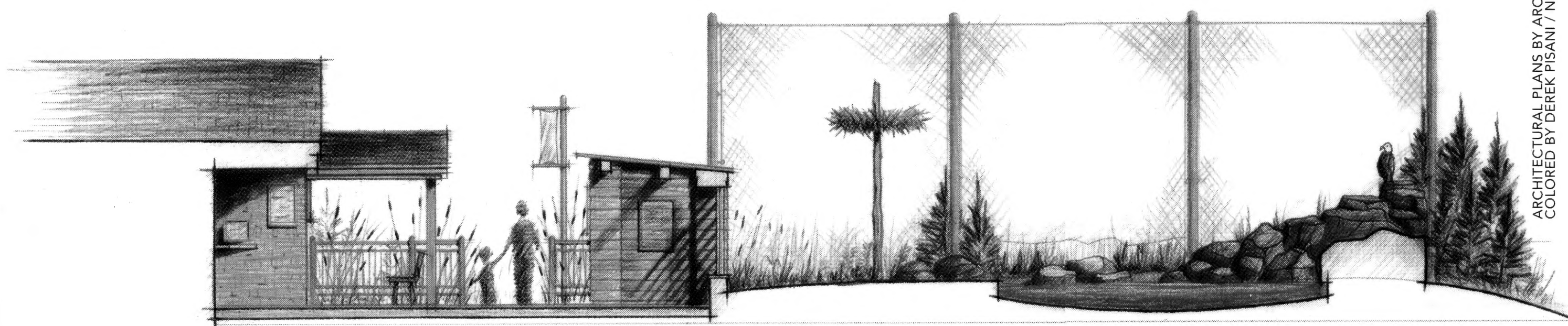
to all Zoo volunteers. Founded in 1987, VANZ works with FONZ to support special events at the National Zoo, promote zoos and related institutions, and facilitate the exchange of information among volunteers.

VANZ supports such special events as Guppy Gala, Focus on Science Weekend, and Boo at the Zoo by recruiting and training volunteers and developing and coordinating activities to make sure our visitors have a fun time and an educational experience.

The VANZ social committee plans activities for volunteers, and since October 2001, we have orga-

nized open-house receptions at the Zoo, as well lectures, tours, and trips to the movies, all serving more than 220 volunteers.

VANZ is a member of the Association of Zoo and Aquarium Docents (AZAD) and, in partnership with the Friends of the National Zoo and the Smithsonian's National Zoo, will host the AZAD convention in September 2005. At the AZAD convention, more than 700 volunteers from around the country will come to Washington to learn about our Zoo and about fellow Zoo and Aquarium docents and volunteers. If you would like to learn more write to VANZEvents@yahoo.com.

ARCHITECTURAL PLANS BY ARCHITRAVE PC
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»»BALD EAGLE REFUGE

This July 4th, the National Zoo celebrates more than the 227th anniversary of the nation's independence. Fittingly, the Zoo will also host an event on that special day to celebrate the opening of a new exhibit called the Bald Eagle Refuge, and the arrival of two eagles from a rehabilitation center in Tennessee.

Free and open to the public, the event is one of several celebrations planned throughout the year by the U.S. Fish & Wildlife Service (USFWS) to commemorate the 100th anniversary of the National Wildlife Refuge (NWR) System. The system has been invaluable in the restoration of the bald eagle, providing vital nesting and wintering habitat at 390 refuges, from the Key West NWR in Florida to the Arctic NWR in Alaska.

The Zoo's Bald Eagle Refuge will be located in Beaver Valley across from the Mexican wolves. In addition to the eagles, the exhibit will feature an interactive video kiosk highlighting conservation success stories, an area for interpretive talks and animal demonstrations, and a special blind through which visitors can view the birds. The 2,430-square-foot exhibit (above) will also include an interactive computer kiosk, recognizing such prominent conservationists as Aldo Leopold, Rachel Carson, and former-president Theodore Roosevelt.

The habitat will emulate the wild habitat eagles favor, and will include a heated natural shelter and perch, naturalistic rock formations and waterfalls, a place for the eagles to nest, and a fish-filled pond. The water in the pond will flow downhill to a wetlands area. A boardwalk will take visitors from the Valley Trail past the wetlands and up to the observation area. The exhibit will be enclosed with a fine, stainless-steel netting that blends into the surroundings and affords visitors a clear, unobstructed view.

»»ONLINE ACTIVITY

Armchair biologists can, with just the click of a mouse, follow the movements of an Asian elephant that Zoo scientists are tracking in the jungles of Myanmar. The female elephant, called Silver Moon, was fitted with a telemetry collar in December and the scientists already know she travels far and wide. So far, her documented home

range covers almost 40 square miles. An animated map, updated about once a week, shows her movements. Go to http://nationalzoo.si.edu/ConservationAndScience/ConservationGIS/projects/asian_elephants/trackingilvermoon.cfm.

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Places of Refuge

*It is hereby ordered that 9
section nine, township thir
east, State of Florida, be,
set apart for the use of
as a preserve and breeding*





age

Perican Island in Indian River in
ty-one south, range thirty-nine
and it is hereby reserved and
the Department of Agriculture
ground for native birds.

—President Theodore Roosevelt,
March 14, 1903



This simple, unremarkable declaration, a mere 48 words, although heartily welcomed by many, was not a major event at the time. The press did not trumpet the news. There was no sense that this was the beginning of something that would produce immeasurable benefits for generations to come. Yet by affixing his signature, Roosevelt officially launched the National Wildlife Refuge System, which is the only network of federal lands dedicated to wildlife conservation. The refuge system is truly an American original. There is nothing else like it in the world. And now, during the refuge system's centennial year, it is an especially fitting time for all Americans to take advantage of the wonders that refuges can provide.

Draped over the land like a vast strand of glittering jewels, the refuge system is one of the greatest of America's natural treasures. Its 538 refuges and thousands of waterfowl-production areas contain 95 million acres, an area larger than the National Park System and about the same size as the state of Montana. There are refuges in every state and many U.S. territories and possessions, and they range in size from the diminutive 0.6-acre Mille Lacs National Wildlife Refuge (NWR), in Minnesota, to the enormous Arctic NWR, which extends over 19.6 million acres of the Alaskan landscape. The refuge system offers an impressive array of habitats—barrier islands, bogs, caves, coastal lagoons, coral

BY ERIC JAY DOLIN

PHOTOGRAPHS BY
JOHN AND KAREN
HOLLINGSWORTH

reefs, deserts, estuaries, hardwood forests, islands, lakes, meadows, mountains, ponds, rocky coastlines, salt marshes, sand dunes, swamps, tall-grass prairies, and tundra. These habitats protect, nourish, replenish, and restore thousands of species of birds, mammals, reptiles, amphibians, fish, and plants, many of which are endangered and hanging on to survival by the weakest of threads.

The refuge system is a priceless gift. It reflects the great diversity of the tapestry of life and the commitment of the United States to wildlife conservation. Wherever visitors go in the refuge system, they will experience a sense of wonder and the joy that comes from nature's company. Each refuge has the power to fill up their senses and stir their souls through sights and sounds, beautiful and sublime. At Oklahoma's Wichita Mountains Wildlife Refuge, the earth trembles as a herd of buffalo thunders past. In the deep blue waters of the Crystal River NWR, in Florida, a manatee glides slowly through the water in search of plants to eat. The wild ponies graze near the shoreline at the

CANYON TREE FROG (*HYLA CADAVE-
RINA*) NESTLES IN A BOULDER IN THE
BUENOS AIRES NWR, ARIZONA.

Chincoteague NWR, in Virginia. And at the Hatchie NWR, in Tennessee, there are scarlet tanagers, yellow warblers, ruby-crowned kinglets, indigo buntings, goldfinches, and green-backed herons and an orchestra's worth of songbird serenades.

The beauty and diversity of the refuge system is revealed in the names of refuges. Those honoring Native American Indians have a lyrical cadence and mystical quality that evoke some of the saddest passages in this country's history—Mattamuskeet, Mashpee, Havasu, Iroquois, and Shiawassee. There are refuges named after famous Americans whose lives have enriched everyone's—John James Audubon, Rachel Carson, Senator John H. Chafee, and Lewis and Clark. Others refuges are labeled more prosaically, highlighting geographic locations or particular species—Gray's Harbor, Cape Romain, Three Arch Rocks, Oregon Islands, Attwater Prairie Chicken, Ozark Cavefish, Florida Panther, and the National Bison Range.

Whereas the creation of the Pelican Island Reservation on March 14, 1903, officially

launched the refuge system, the latter's true origins reach back to the colonial era and then follow the tendrils of history through the early 1900s. In that relatively short span of time, a mere blip in the history of the land, the colonists and their descendants transformed the New World and subdued nature to an astonishing degree. Wildlife once thought to be inexhaustible was pushed up to and sometimes over the brink of extinction. The notion of protecting and preserving wildlife from the ravages of civilization moved from the realm of isolated necessity to the point of being a widely accepted idea whose time had come.

The history of the so-called Age of Extermination is full of stories in which species of wildlife were eliminated from vast expanses of their historical ranges, killed in enormous numbers, or completely annihilated. For example, great auks, large flightless birds that had summered in the millions along the northeastern coast of the United States, were mercilessly killed for their feathers, oil, and flesh by hunters, skin collectors, and fishermen who cut up the birds

for cod bait. Unable to outrun their pursuers, the auks were easily dispatched with a swing of a club to the head. In early June 1844, the last two birds of this species ever seen were killed on a volcanic outcropping near the coast of Iceland, their skins sold to a Danish collector for £9. Elk and wild turkey, once plentiful in New York, had by the mid-1800s disappeared due to hunting pressures. And during this period of time, it was not unusual for gunners on the Chesapeake Bay to kill upward of 15,000 ducks in a single day.

The most dramatic and oft-told stories of wildlife destruction in America involve the passenger pigeon and the bison. Better examples of humankind's ability to decimate wildlife are hard to find. Billions of passenger pigeons once blanketed the sky over North America in flocks so densely packed that observers claimed that the birds blotted out the midday sun. But by the beginning of the 20th century, relentless hunting had erased this species from the Earth. The bison almost shared the same fate. When the conquistadors were exploring the Great Plains, and even before the English had set foot on the eastern

THE ENDANGERED MANATEE (*TRICHECHUS MANATUS*) IS AT HOME IN THE CLEAR WATERS OF THE CRYSTAL RIVER NWR, FLORIDA.





EGGS OF A LEAST TERN (*STERNA ANTILLARUM*) IN A SHALLOW NEST AT THE SALT PLAINS NWR, OKLAHOMA.

shores, there might have been up to one hundred million bison roaming the continent; by the late 1800s only a couple of hundred remained.

The increasingly desperate situation of wildlife toward the end of the 19th century spawned private efforts that would lead to the creation of the refuge system. The American Ornithologists Union, the Audubon Societies, *Forest and Stream*, the Boone and Crockett Club, and other like-minded organizations and individuals combined to raise the cause of wildlife protection to that of a national crusade. This concern was reflected in state and federal laws aimed at limiting the killing of wildlife, but by the beginning of the 20th century many believed that it was as important to set aside habitat to sustain wildlife populations and allow them to grow.

The need for habitat was particularly critical in Florida. Years of market hunting had decimated the populations of many birds whose plumage was used extensively in the millinery trade. The American Ornithologists Union was especially interested in protecting Pelican Island, a five-acre piece of land located on the east coast of Florida, across from the small village of Sebastian, about 135 miles north of Miami. Pelican Island played host to between 2,000 and

3,000 brown pelicans and was well known as the only breeding site of these birds on the Atlantic coast. When it was suggested to President Theodore Roosevelt that he set aside the island to protect the birds, he reportedly asked one of his assistants, "Is there any law that will prevent me from declaring Pelican Island a federal bird reservation?" Upon hearing that there was not, Roosevelt said, "Very well, then I so declare it," and on March 14, 1903, he signed the executive order creating the Pelican Island Reservation, the

"IS THERE ANY LAW THAT WILL PREVENT ME FROM DECLARING PELICAN ISLAND A FEDERAL BIRD RESERVATION? VERY WELL, THEN I SO DECLARE IT."

first of all the refuges established in what was to ultimately become the National Wildlife Refuge System.

Theodore Roosevelt's concern for the pelicans and his establishment of the Pelican Island Reservation were not the least bit surprising. The man who would earn the moniker of "the Conservation President" had loved nature and wildlife for most of his life. Over the remainder of his presidency, Roosevelt repeatedly used his executive powers to set aside bird refuges, ultimately creating 51. And Roosevelt wasn't con-

cerned only about birds. His intimate connection with big game led him to wield his powers for their protection, as well, by establishing the Wichita Mountains Wildlife Refuge and National Bison Range, both of which played an important role in bringing bison back from the brink of extinction.

The history of the refuge system, which is administered by the U.S. Department of the Interior's Fish & Wildlife Service, mirrors this country's fascinating, colorful, dramatic, at times disastrous, and often inspirational relationship with wildlife. The refuge system has grown more opportunistically than strategically. Decade after decade, a combination of executive orders,

statutes, direct purchases, and donations have added refuges and acreage to the refuge system. All the while, this amazing network of lands has been buffeted by conflicting imperatives, budgetary and natural droughts, management problems, organizational changes, and the mounting pressures of protecting itself from the increasingly potent threats posed by population growth and development.

The refuge system has succeeded, first and foremost, because of the amazing and too often unheralded dedication and hard work of its

MUSKRAT (*ZAPAS HUDSONIUS*) FEEDING ON BULL-RUSHES AT THE MODOC NWR, CALIFORNIA.

employees, those whom the American people have, in effect, hired to be caretakers of a significant part of the country's wildlife heritage. The refuge system is also indebted to untold thousands of other government employees, politicians, nonprofit organizations, and volunteers who not only believed in it but also fought to make it work by turning obstacles into opportunities. The fruits of their labors are on view every day.

The numbers of migratory waterfowl that rest, feed, and breed on refuges have swelled to all-time highs from all-time lows. Large game, such as bison, elk, and pronghorn antelope, are prospering on refuges in the American West. Tens of millions of acres in the refuge system are designated as wilderness, places where human impact is vanishingly small, and nature approaches its original state. Through active management, marginal refuge lands have been transformed into productive areas that benefit all the species that live in or migrate through them. Scores of refuges are providing habitat necessary for endangered species to sur-



CANIS RUFUS, THE RED WOLF, IS BEING REINTRODUCED TO THE ALLIGATOR RIVER NWR, NORTH CAROLINA.

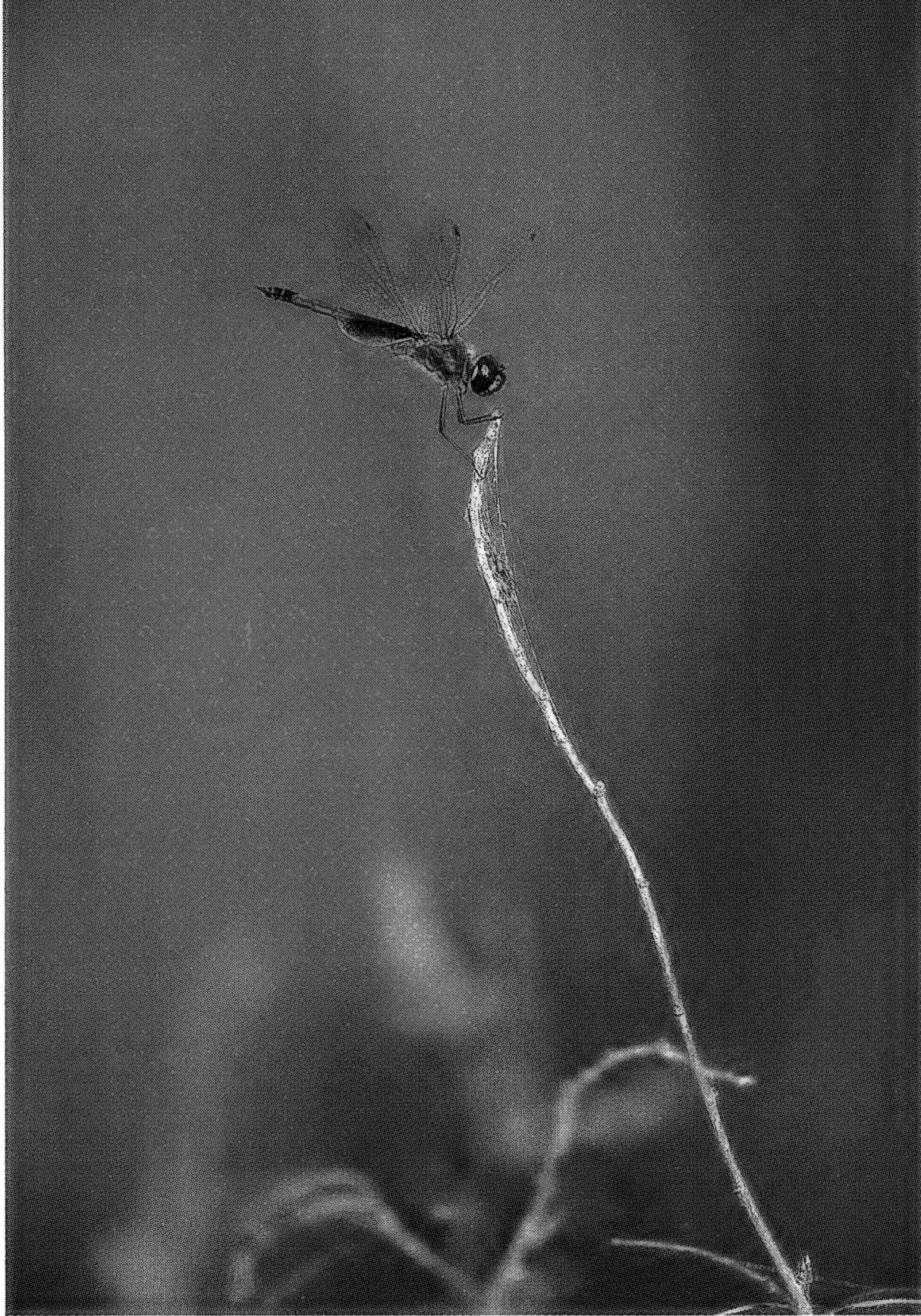
vive and thrive. And on virtually every refuge in the country, any time of year, the magnificent rhythms of nature are played out with heartening regularity: a mouse digging a burrow, a jellyfish undulating through sun-flecked water, a swan alighting on a still lake, a mother bear protectively watching over its cubs, and a mighty tree swaying in the breeze before a coming storm. These are simple events, perhaps, but ones as important as the greatest works of humanity.

The refuge system places wildlife first. According to the National Wildlife Refuge System Improvement Act of 1997, "The mission of the System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitat for the benefit of present and future generations of Americans." Although wildlife comes first on refuges, they are also the people's lands, intended for the recreation and enjoyment of all. Visitors may see binoculars raised in unison as a



WOOD STORKS (*MYCTERIA AMERICANA*) WITH YOUNG IN THE HARRIS NECK NWR, GEORGIA.





A SKIMMER DRAGONFLY PERCHES AT THE SANTA ANA NWR, TEXAS.

group of patient birders spies a rare species on a distant branch. A boy and his father cast into the deep waters of a cold lake creating memories and hoping for a fish to bite. Hikers in a wilderness area stand on the spine of an exposed ridge and see nothing but the natural landscape in every direction. Schoolchildren listen in rapt attention as a refuge volunteer talks about the species they are likely to see on their nature walk. A photographer zooms in on a hillside and with a quick

press of a button captures forever the image of a bighorn sheep bounding across rough terrain. And, on the edge of a marsh, two hunters wait silently in a blind for geese to arrive. Every year, nearly 40 million people visit refuges for a special experience. But humanity's interactions with the refuge system are often less personal. Oil and gas drilling, mining, farming, grazing, timbering, and military exercises are also acceptable activities on refuge lands, as long as they don't interfere with the purposes for which the refuge was established. The varied use of refuges is a strength as well as a weakness. The refuge system provides numerous benefits but is often stressed and strained in doing so. This is part of the dynamic tension that makes managing the refuge system such a challenging task.



ANNUAL BISON (*BISON BISON*) ROUNDUP AT THE NIOBRARA NWR, NEBRASKA.

Deciding what types of activities are acceptable on refuges is often extremely difficult and contentious. Nowhere is this more evident than in the ongoing debate over whether to allow oil drilling in the Arctic NWR. It is not surprising that the numerous studies and reports that have dealt with this issue have done little to temper the debate. The gulf separating the two sides is as much a function of values as it is of facts, especially when the latter are often the subject of disagreement. How, for example, can one bridge the gap between people who view the Arctic refuge as simply a desert with snow and those who agree with former Supreme Court chief justice Douglas, who pronounced many years ago that "this last American living wilderness must remain sacrosanct." Like the epic battle over the Hetch Hetchy dam in Yosemite National Park, led by John Muir around the turn of the 19th century, the battle over the fate of the coastal plain

AREAS IN THE REGION WHERE BALD EAGLES CAN BE SEEN INCLUDE:

MARYLAND:

Blackwater National Wildlife Refuge — Cambridge
<http://blackwater.fws.gov/>

Conowingo Dam on the Susquehanna River, north of Port Deposit
<http://www.harfordbirdclub.org/conowingo.html>

Flag Ponds Nature Park — Lusby
<http://calvert-county.com/flagpond.htm>

Jefferson Patterson Park — St. Leonard
<http://www.jefspat.org/>

Susquehanna State Park — Jarrettsville
<http://www.dnr.state.md.us/publiclands/central/susquehanna.html>

VIRGINIA:

Mason Neck State Park — Lorton
<http://www.dcr.state.va.us/parks/masonneck.htm>

Mason Neck National Wildlife Refuge — Lorton
<http://northeast.fws.gov/va/msn.htm>

Rappahannock River Valley National Wildlife Refuge, east of Fredericksburg
<http://www.dgif.state.va.us/wildlife/vbwt/site.asp?site=CNN19&loop=CNN>

The Caledon Natural Area, east of Fredericksburg
<http://www.dcr.state.va.us/parks/caledon.htm>

A good place to spot bald eagles in the Caledon Natural Area is west of the U.S. 301 Bridge on the south shore of the Potomac River.

FOR MORE INFORMATION:

The Chesapeake Bay Program
http://www.chesapeakebay.net/bald_eagle.htm

American Bald Eagle Information website
<http://www.baldeagleinfo.com/>

Center for Conservation Biology, the College of William & Mary
http://fsweb.wm.edu/ccb/eaglevideo/eag_home.htm

As the symbol of the United States of America, the American bald eagle (*Haliaeetus leucocephalus*) embodies the virtue of this free nation. Now, more than 200 years after this magnificent raptor's selection as the national symbol, the recovery of the bald eagle from near extinction stands as a crowning achievement of this country's conservation efforts, and as a symbol of hope that those efforts are not in vain.

According to the U.S. Fish & Wildlife Service (USFWS), when the founding fathers chose the bald eagle as the national symbol in 1782, as many as 100,000 eagles nested in the continental United States, excluding Alaska, home to one of the country's densest eagle populations. As a result of habitat destruction, human persecution, and—most notably—the use of the pesticide DDT, by 1963, only 417 nesting pairs of bald eagles occupied the lower 48 states.

Thanks to the banning of DDT in 1972 and the recovery efforts of the USFWS, many other state and federal agencies, conservation organizations, and public and private groups, this American icon has made a dramatic comeback. With about half of North America's 70,000 bald eagles in Alaska, and about 12,000 now well established in the lower 48 states, the recovery of the bald eagle is a true success story. For those of us living in the Chesapeake Bay region, the fruits of these restoration efforts can be readily enjoyed within a few hour's drive—sometimes even in our own backyards.

The Chesapeake Bay and its tidal tributaries have long been a bald eagle stronghold. Near the turn of the 20th century, more than 1,000 pairs of eagles inhabited the Bay. It is even reputed that the country's largest estuary once had a bald eagle nest along every mile of waterfront.

Today, according to the USFWS's Chesapeake Bay Field Office, the Chesapeake Bay watershed has one of the highest concentrations of bald eagles in the lower 48 states, boasting a population of more than 2,000 birds. In addition to the breeding population, the Bay supports winter migrants from as far north as Canada and summer migrants from Florida. The Bay's breeding birds, which lay their eggs before the start of spring each year, usually do not migrate. As a result, bald eagles can be viewed in the Chesapeake Bay region at any time throughout the year. One just has to know where to look.

Maryland's Department of Natural Resources (DNR) reports that most bald eagle nests in this region occur within one mile of the Bay and its tidal tributaries, with 60 percent found in mature loblolly pines, as well as in tulip poplars and oaks along the shores of rivers

like the Chester, Choptank, Patuxent, and Potomac. They can also be found along nontidal areas of the Potomac and Susquehanna Rivers, as well as large reservoirs, such as Loch Raven and Triadelphia in Maryland. The latter is located near the town of Olney, about 30 minutes from downtown Washington. If that's not close enough for D.C. residents, *The Washington Post* reported in May that for the sixth year a pair of bald eagles has taken up residence on Rosilie Island near the Maryland shore of the Potomac and a stone's throw away from the Woodrow Wilson Bridge. However, according to the *Post*, bridge officials are asking birdwatchers to resist the temptation to view the eagles because the nest can only be seen from the river, which currently hosts an active construction site.

According to the DNR, two locations in Maryland where these impressive sights are most commonly seen are Blackwater National Wildlife Refuge (NWR) in Cambridge and the Susquehanna River below Conowingo Dam in Harford County, where eagles nesting at Aberdeen Proving Ground often feed. Each of these populations boasts more than 100 individuals.

Many of Blackwater's nesting birds can be seen from Wildlife Drive, a six-and-a-half-mile path that affords the best views of the eagles. Located on Maryland's Eastern Shore, Blackwater NWR is only about a two-hour drive from Washington. However, some residents of the Chesapeake Bay region needn't travel any farther than their own backyards to catch a glimpse of the nation's symbol.

From Virginia Beach, Virginia, to Port Deposit, Maryland, people who live and work around the Bay and its tributaries have the opportunity in their everyday travels to view, if only for a fleeting moment, one of the world's most spectacular birds. The website www.baldeagleinfo.com features stories submitted by people all over the country who have been so fortunate. Eighteen Maryland and

Virginia residents have shared their stories on this site, including an Alexandria resident whose apartment window provides a bird's eye view of an eagle nest, as well as a locomotive engineer who watched an eagle fly alongside his train as it rumbled along the Susquehanna.

As exceptional as these sightings are, forty years ago they would have been rare indeed, here or anywhere else in the contiguous United States. Thanks to the efforts made to save the American bald eagle from extinction, we once again have the opportunity to view, in its rightful place, this vital part of our country's national and natural heritage.

—Matt Olear, writer and media specialist, FONZ

ON OBSERVING THE

CHESAPEAKE'S EAGLES



BALD EAGLES AT THE REELFOOT NWR IN TENNESSEE.

DAVID HAGGARD / U.S. FISH & WILDLIFE SERVICE



JAMIE RICHIE

FOR WILDLIFE AND PEOPLE

THE NATION'S WILDLIFE REFUGES AND ZOOS: PARTNERS FOR CONSERVATION.

It has been more than 100 years since the Smithsonian's National Zoo first opened its doors, bringing a world of wildlife to our nation's capital. Since its inception, the National Zoo has played a pivotal role in the conservation of some of the world's most spectacular—and endangered—wildlife. Just as zoos around the country work in tandem to conserve and protect wildlife, the National Wildlife

Refuge System's (NWRS) network of federally protected refuges provides vital breeding and wintering habitat for many wild animals throughout North America. Part of the United States Fish & Wildlife Service, the NWRS is dedicated to the conservation of our nation's wildlife, from the fish in our streams to the elk in our mountains and everything in between.

The NWRS encompasses 540 refuges and more than 3,000 waterfowl-production areas, all of which provide habitat for 700 species of birds, more than 200 species of fish, and nearly 500 other animal species. Within the National Wildlife Refuge System are 260 threatened or endangered plants and animals, including our national symbol, the American bald eagle. And with support from more than 40 zoos, these refuges act as rescue and recovery zones for many species facing extinction, where biologists and wildlife managers work to restore once-depleted populations of white-tailed deer, whooping cranes, elk, wild turkeys, crocodiles, wood ducks, pronghorn antelope, and a host of other species.

The wildlife refuges comprise a stunning array of critical habitat such as tundra, desert, forest, marsh, prairies, and coral reefs. On Delaware's tidal shores at the Bombay Hook National Wildlife Refuge, millions of horseshoe crabs mate on protected beaches, and are followed by tens of thousands of migrating shorebirds that stop to refuel on billions of crab eggs.

The Chincoteague National Wildlife Refuge on the eastern shore of Virginia is one of the top staging areas for migrating shorebirds in the United States. In early spring, visitors flock to the 14,000-acre refuge by the hundreds of thousands to add unusual shorebirds to their life list, or simply to observe as many as 15,000 birds in any one day!

At the 15,000-acre Canaan Valley National Wildlife Refuge, with an altitude of 3,200 feet, there are views of the highest valley of its size east of the Rocky Mountains, featuring a climate typical of areas much farther north. Drained by the Blackwater River, the valley contains

the largest freshwater wetland area in West Virginia, and miles of hiking trails offer unique views of the boreal forest and its wildlife. The refuge's fall foliage attracts—and inspires—hundreds of photographers each year.

The wonders of our refuges take on a special significance during the 100th anniversary of the National Wildlife Refuge System, celebrated this March. Yet,

were it not for the cooperation of our partners, including the National Zoo, the National Wildlife Refuge System might not have the wealth of wildlife it supports today. From coast to coast, zoos provide vital information enabling refuge managers to provide care not only for animals, but also for the habitats basic to the animals' survival.

With the cooperation of U.S. and Canadian groups, the San Antonio Zoo provided valuable research aiding in the reintroduction of the whooping crane to its historic range. The Brevard Zoo, located in Melbourne, Florida, has a close relationship with the Merritt Island Wildlife Refuge. The resources of both entities enhance the educational opportunities for students in the community. One involves a four-hour, ecological tour by kayak of a lagoon in the refuge.

National Zoo scientists are currently working with the Charles M. Russell and UL Bend National Wildlife Refuges in Montana to conserve the black-footed ferret, a highly threatened species once considered the most endangered mammal in North America. Since 1988, the Zoo has collaborated with the USFWS and other agencies to breed black-footed ferrets and reintroduce them to their native habitat in the American prairie. The ferret has made a dramatic recovery since the population reached its lowest point in the 1980s, but it is not out of the woods yet. Zoo scientists are now working with these two refuges to conduct a biomedical survey of a failing black-footed ferret population in Montana.

Today, more than 30 million people visit our National Wildlife Refuges every year, yet the vast majority of Americans have yet to set foot on a wildlife refuge. So as the refuge system celebrates its 100th anniversary, log on to <http://refuges.fws.gov>, I encourage you find a refuge near you and enjoy the simple pleasures of slowing down and getting out into nature. There are at least six wildlife refuges within an easy drive of Washington, D.C., offering a chance to take a drive and reconnect with nature and our natural heritage. You'll be surprised by what you find.

—William Hartwig, Chief National Wildlife Refuge System

WHOOPING CRANES (*GRUS AMERICANA*) ON OPERATION MIGRATION, WHICH USED ULTRA-LIGHT AIRCRAFT TO TEACH A NEW AND SAFE MIGRATORY PATHWAY TO THE ENDANGERED BIRDS.



has become a national cause célèbre, in which both sides have staked their claims and are willing to use all the resources at their command to prevail. There have been many attempts to pass bills that would allow for oil leasing, but none has passed. And the battle shows no sign of ending. Like other extremely emotional, complex,

Steering the refuge system over the next 100 years will not be easy. Managing wildlife is hard work, made more difficult by the complex makeup of

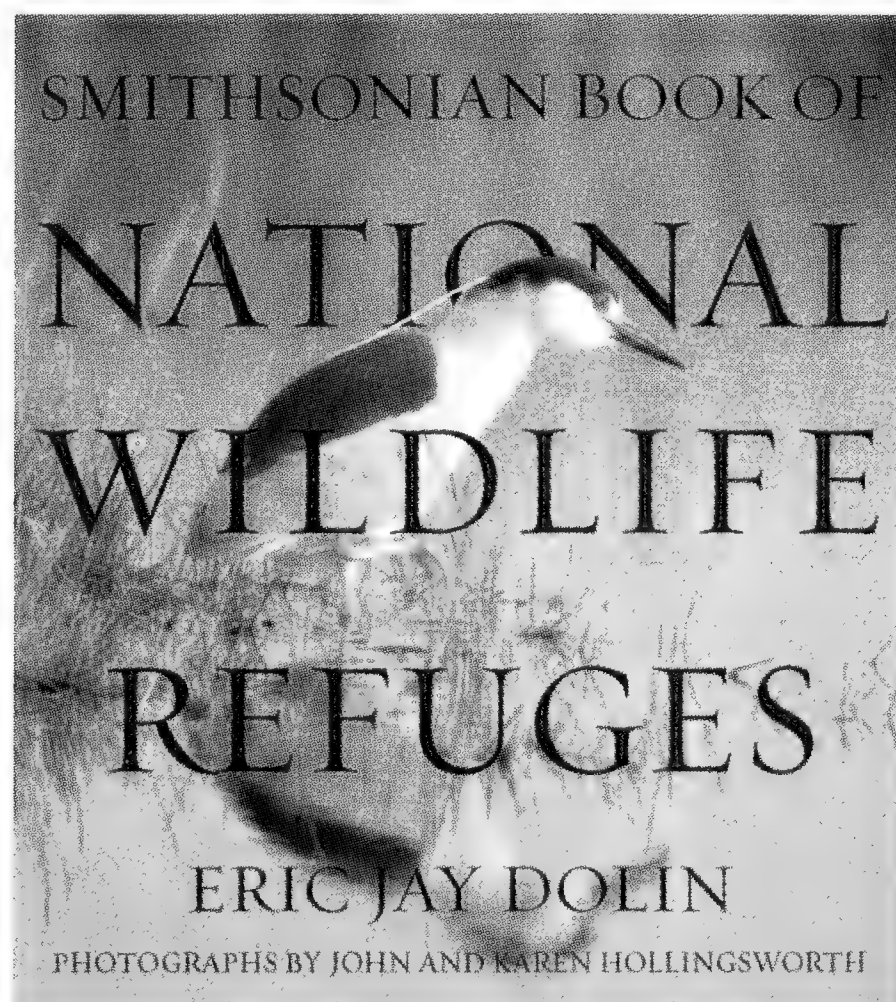


A SNOWY OWL (*NYCTEA SCANDIACA*) AT THE SACHUEST POINT NWR, RHODE ISLAND.

contentious, and values-laden public issues, drilling in the Arctic refuge will probably remain a major part of the U.S. political landscape for years to come.

As the refuge system heads into its second century, its future looks bright. The goals of the refuge system are clear—wildlife comes first and other uses are allowed only when the well-being of wildlife will not be compromised. Recent budget increases, if built upon in the future, hold out the prospect of someday paring away and, hopefully, eliminating the massive backlog of operational and maintenance needs that are weighing down the refuge system and keeping it from fully achieving its potential. And the centennial celebrations already underway will energize the process of introducing and reintroducing Americans to this wondrous network of protected lands that they all own in common.

the refuge system and its many, at times competing, constituencies. Public and economic uses of refuges must be carefully designed and implemented to ensure that they are compatible



with wildlife management goals. The spread of development and the corresponding decrease in the country's reserves of wild and open spaces will place added pressures on the refuge system as people, weary of manufactured landscapes, seek out the pleasures that nature provides. While the refuge system should welcome more visitors, it must guard against the dangers of being loved too much. Also, as the refuge system adds more units, its need for funding will grow. Thus, even if efforts to fully fund existing operational and maintenance needs are successful, there will still be other financial battles to be fought in the future.

The United States made an unparalleled commitment to protecting and preserving wildlife through the creation and growth of a refuge system that is not only one of this country's greatest conservation success stories but also an important part of the American experience. Strangely, for lands that have provided so many benefits for so long, the refuge system is relatively unknown to many Americans. It is largely a hidden treasure, but it shouldn't be. The refuge system is arguably the best way to ensure that current and future generations have an opportunity to appreciate the glory of wild America. This archipelago of diverse habitats is an integral part of this country's intimate connection to wildlife and wild places. It helps to define the character and values of the United States, and it deserves respect, support, and admiration.

—Eric Jay Dolin is a writer living in Marblehead, Massachusetts, and is the author of the Smithsonian Book of National Wildlife Refuges, upon which this article is based. This September, Smithsonian Books will publish another of Dolin's books entitled, *Snakehead: A Fish Out of Water*.

Endangered Species

BY CHRISTOPHER MIMS

"In Serra Leoa, there lives a kind of monkey not found elsewhere in Guinea; they are called daris, and have no tail, and if they were not hairy it would be possible to declare that they were human like ourselves..."

—Andre Alvares de Almada, 1594

A SAO-TIAGO-BORN LUSO-AFRICAN trader by the name of de Almada introduced the beast now known as the chimpanzee (*Pan troglodytes*) to the annals of recorded history. In excerpts of a treatise published in a Jesuit monograph, translated into English for the first time only in 1984, he recorded the habits of a creature "so clever that if they happen to be captured when young and are brought up in a house, they go to the river to seek water and bring it back in a pot on their head." Twenty years later Andrew Battell published the first English account of the chimpanzee (alongside a host of other "monsters") in a book entitled *Purchas his Pilgrimage*. Two hundred years later, some scholars argue, his manuscript served as Shakespeare's model for the man-beast Caliban.

Endangered Science

FEATHER IDENTIFICATION EXPERT ROXIE LAYBOURNE (FOREGROUND) STANDS AMONG THE COLLECTIONS OF THE SMITHSONIAN'S NATIONAL MUSEUM OF NATURAL HISTORY.





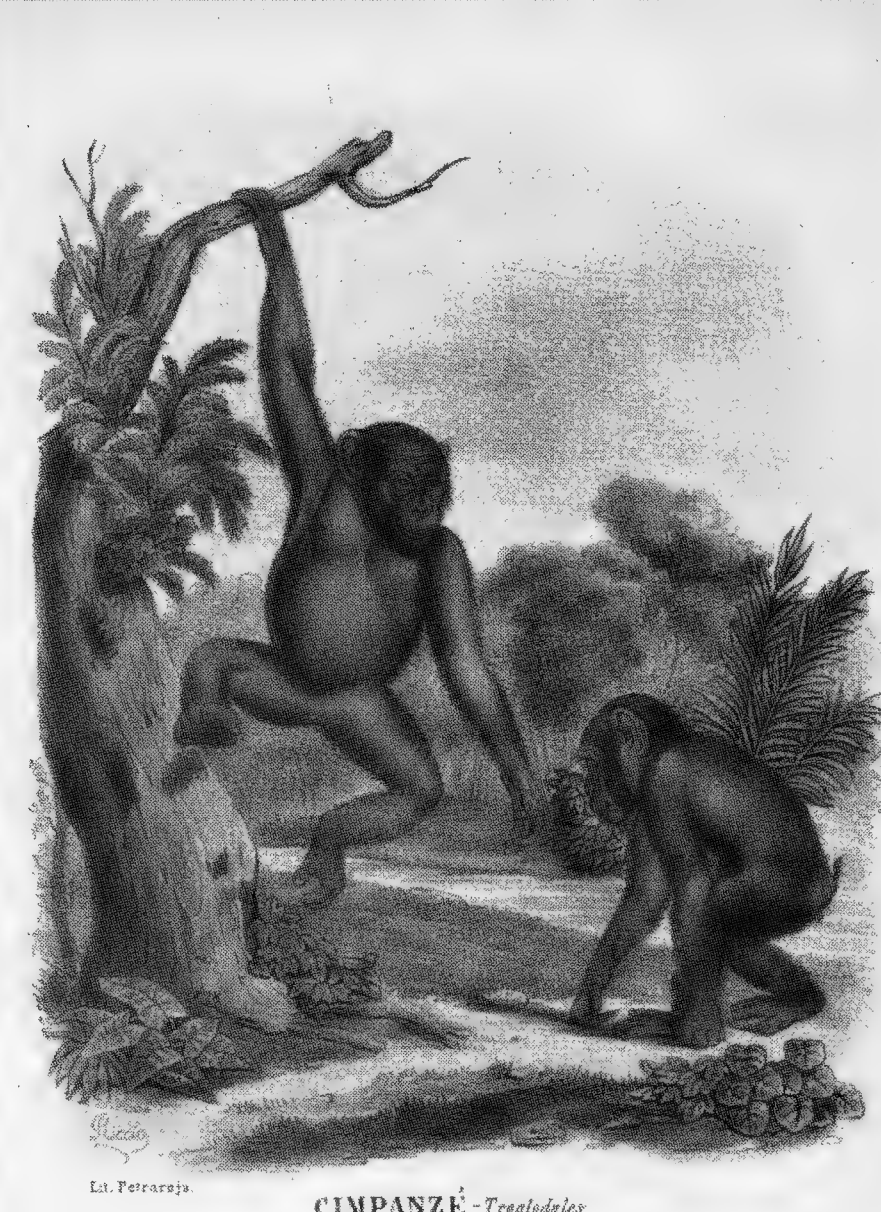
MARC G.M. VAN ROOSMALEN

RECENTLY DOCUMENTED BRAZILIAN TITI MONKEY
(*CALLICEBUS BERNHARDI*).



ROBERTO VÁSQUEZ / KOORDINATION

BOLIVIAN ORCHID NAMED *MAXILLARIA GORBATSCHOWII*
FOR MIKHAIL GORBACHEV.



AN EARLY ILLUSTRATION OF THE CHIMPANZEE, ORIGINALLY CALLED *SIMIA SATYRUS* BUT LATER CHANGED TO *PAN TROGLODYTES*.

De Almada and Battell lived at the dawn of an age of discovery. The desire for profit pushed the French, Spanish, English, Dutch, and Portuguese to the ends of the Earth in search of new lands and new opportunities for trade and exploitation. It was an era in which, as some naturalists romanticize it, explorers couldn't turn over a rock or look into the canopy without discovering a new family on the tree of life.

This excitement about the vast biological potential of *terra incognita*, those same "white spaces" on the map that thrilled a young Joseph Conrad and sent him sailing round the world, inspired the dawn of a new sort of natural philosophy. Just as the Greeks classified rhetoric, and Ptolemy the stars, scientists of the day bow-ed to the instinct to categorize the new life forms revealed in the fanciful accounts of early explorers.

In spite, or perhaps because of, all the excitement, taxonomy remained a hodge podge of anecdotal accounts of the kind published by de Almada and Battell for some 150 years. In the mid-18th century, Carl Linnaeus, the Swedish-born naturalist and father of the "binomial system of nomenclature," or the convention of a two-part name for every species, set down in his *Systema Natura* what was then known of the plant and animal world. (To the chimpanzee, he gave the poetic but later suppressed appellation *Simia satyrus*.)

In the 150 years that followed, with its peak during the Victorian era, taxonomy reigned supreme among the biological sciences. Vast collections of specimens accrued to the museums of Europe, the largest among them residing in Britain's Museum of Natural History and Kew Royal Botanical Gardens. Type specimens were dried, pickled, or stuffed, and then named, catalogued, and largely forgotten. Systematists, as they're also known, squirreled away samples of the bulk of Earth's diversity and then left it to gather dust. Technology advanced and the modern reconception of organisms as molecular machines pushed taxonomy right off the stage.

ALIENS AMONG US

This isn't to say that new species aren't still uncovered, even in relatively well-studied groups.

John Dumbacher, a research associate at the Smithsonian's National Zoo who made a name for himself by serendipitously discovering the first poisonous bird known to science (the well-studied pitohui birds of New Guinea), now believes that what ornithologists once believed was a single species of his famous pitohui is in fact three.

"The genetic data very clearly split them into three groups," said Dumbacher, whose data may also help explain how, in a process known as Mullerian mimicry, poisonous birds around the island came to look like one another—an evolutionary advertising campaign that perhaps more effectively alerts predators to avoid their kind.

Phylogenetic hair splitting aside, organisms wholly new to science also appear with some regularity. One hot day last July, a *New York Times* article sported the headline "A New Kind of New Yorker." The native in question, an inch-long centipede found in the leaf litter of Central Park, set off a media firestorm owing to the fact that the last time scientists found a new species in New York City, Teddy Roosevelt was in the White House.

Richard Hoffman, an entomologist at the Virginia Natural History Museum, examined the centipede before sending it to an Italian colleague who promptly declared it new to science and

**WE SHOULD BE EMBARRASSED TO BE LIVING
ON SUCH A LITTLE-KNOWN PLANET.
—E.O. WILSON**



SYMBION PANDORA: ITS NAME REFERS TO THE INTIMATE SYMBIOTIC RELATIONSHIP WITH ITS LOBSTER HOST AND FOR THE EXPERIENCE SCIENTISTS HAD UNRAVELING ITS COMPLEX LIFECYCLE.

PETER FUNCH / UNIVERSITY OF AARHUS



ARTIST MARK DION DEPICTS SCIENTISTS AT WORK.

MARK DION



THOMAS KUJAWSKI / ASA-MULTIMEDIA, GERMANY

THE NAMIBIAN "GLADIATOR" (*MANTOPHASMA ZEPHYRA*) IS PART OF THE MANTOPHASMATODEA, RECENTLY RECOGNIZED AS A NEW ORDER OF INSECT.

named it for Hoffman (*Nannarrup hoffmani*). In contrast to the *Times*' excitement, Hoffman remained unimpressed. "Talk about a tempest in a teapot! The media have gone berserk with this stupid centipede: You'd think we had a cure for cancer or AIDS," he wrote in an email correspondence. Hoffman isn't belittling the accomplishment. He's pointing out what too few in the media, and presumably the public, know: "That a new genus turned up in Central Park is simply a reflection of how little we still know."

Fifteen thousand new species appear in the scientific literature every year, and yet we have documented only something between two and 13 percent of all the things alive on Earth today. We don't know how many are yet to be discovered to within an order of magnitude.

By best estimates, humankind has catalogued 1.75 million species, or 12 million fewer than the proposed total.

Insects represent two-thirds of all named species on Earth, outnumbering the next most diverse group by a factor of ten, and in so doing grant entomology the title of most prolific disgorging of new finds. Explorers questing after big game come in last place, having to settle for the discovery of a new species of large mammal once every three years, and a new large vertebrate from the open ocean every five.

Even the roots of the tree of life are not immune to the steady flow of revelations. In the late 1970s, scientists were blown away by the discovery, via DNA sequence analysis, that the

Archea (formerly grouped in with bacteria) represented a whole new domain of life, bringing to three the divisions of highest classification (into Eukaryota, Eubacteria, and Archaea). In 1995, Reinhardt Kristensen and Peter Funch found a new phylum living on the mouthparts of the Norway lobster. The phylum is currently made up of *Symbion pandora*—a tiny epizote (an organism that lives on the surface of another living creature) with a complicated life cycle and bizarre body plan—and its discovery brought the number of known animal phyla to 34. Within

one percent of all bacteria and viruses. If biologists are right about what is still only conjecture, and every species of multi-cellular life big enough to be visible to the naked eye has endemic to it at least one species of parasitic nematode, protozoan, bacterium, or virus, it could send species counts through the roof.

According to evolutionary biologist Stephen Jay Gould, there are more species alive right now than there have ever existed at any other time on Earth. So why, when faced with a diversity so vast, and an extinction rate so catastrophic, are we

recording and analyzing Earth's diversity at a pace so leisurely that it will take nearly 600 years to complete even a preliminary catalog of life?

THE TAXONOMIC IMPEDIMENT

Taxonomists are the workhorses of species collection and identification. When a biologist finds an organism she believes to be new, she brings in an expert, or mails the sample to one of the few people in the world who can, like a patent clerk buried in the annals of mother nature's inventiveness, search the literature and tell her if she's right. Even after a species has been recognized as new, it can take years of comparison and study to identify where it belongs on the tree of life. It's tedious, difficult work that requires enormous patience and equally generous hoards of experience and knowledge. Without taxonomists, cataloging new species would be impossible.

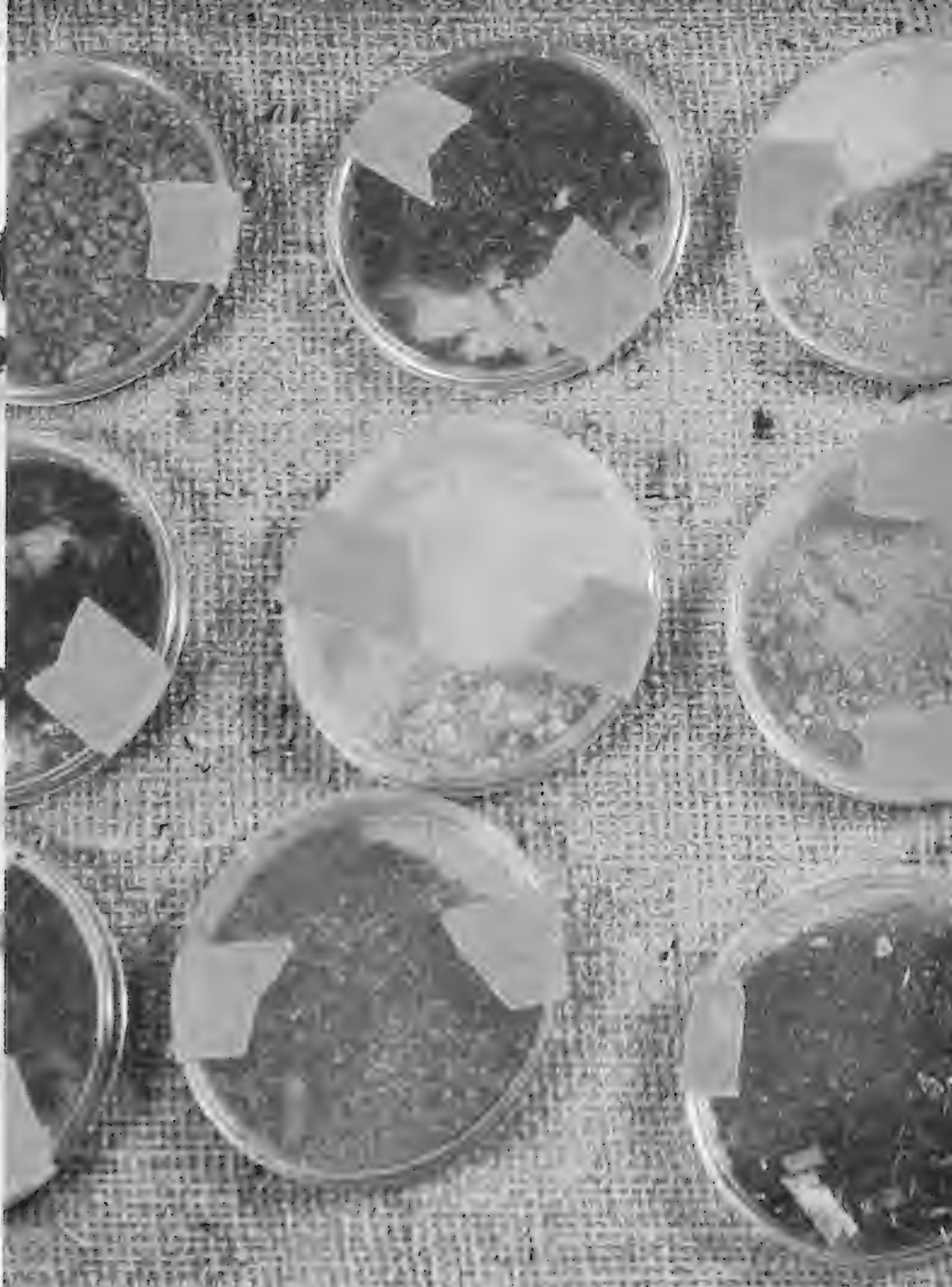
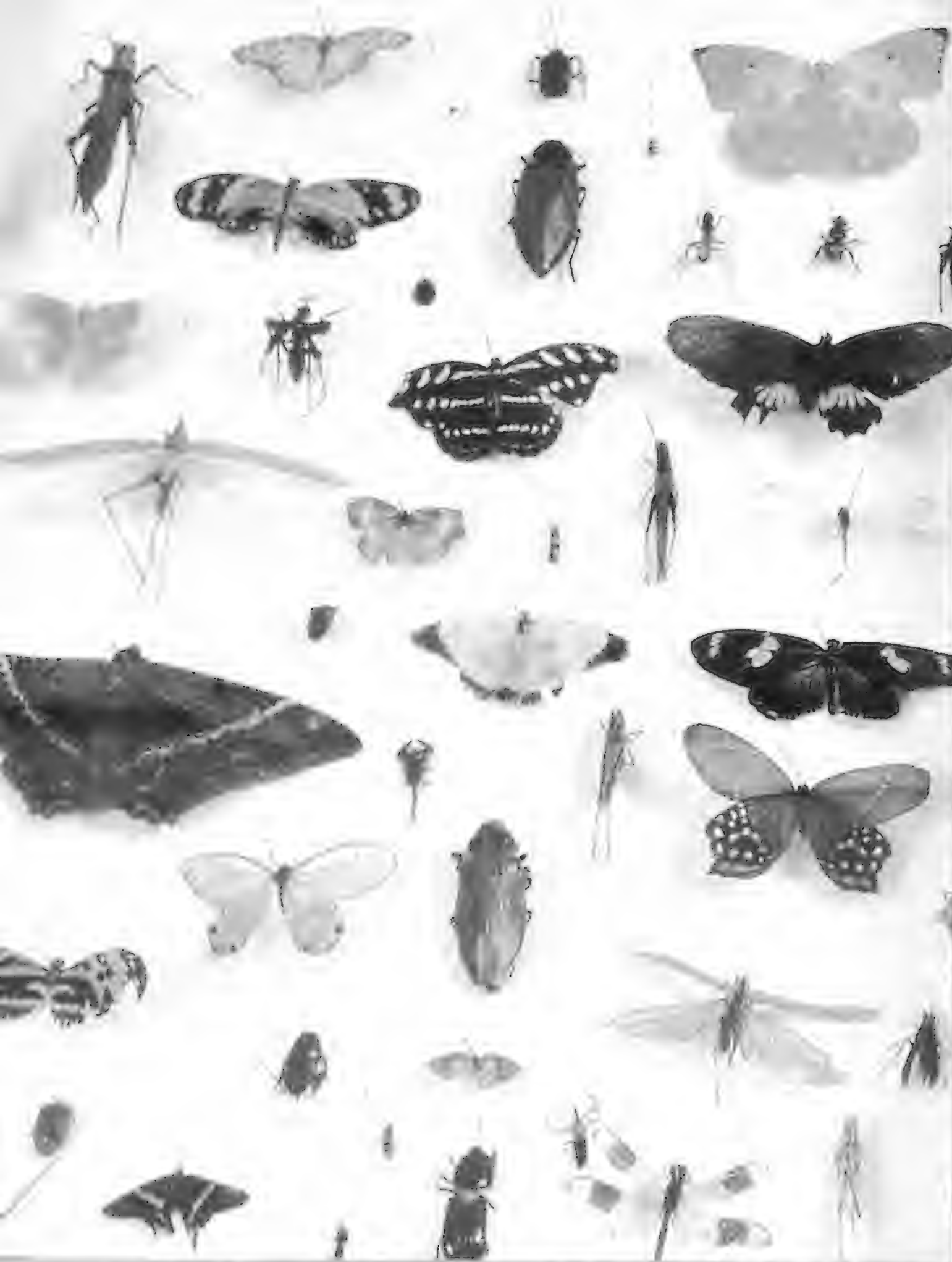
Yet the Invertebrate Conservation Trust, a non-profit organization based in the United

FIFTEEN THOUSAND NEW SPECIES APPEAR IN THE SCIENTIFIC LITERATURE EVERY YEAR, AND YET WE HAVE DOCUMENTED ONLY SOMETHING BETWEEN TWO AND 13 PERCENT OF ALL THE THINGS ALIVE ON EARTH TODAY.

Archea, many of which live in difficult-to-study habitats (for example, miles below the Earth's surface), new phyla are discovered at the rate of one a month.

By comparison, about 15,000 newly documented species appear in the scientific literature every year. A new large mammal is documented once every three years. A large vertebrate from the open ocean every five years. An entirely new phyla is discovered once a month.

Scientists have named about 80 percent of all the plants and large animals on Earth. Unfortunately, these taxa represent only a tiny fraction of our home planet's biodiversity. As for the rest, we have cataloged only ten percent of all living insects, 20 percent of fungi, and less than



ARTIST MARK DION HAS CREATED A VARIETY OF IMAGES THAT REFLECT THE WORK OF BIOLOGICAL COLLECTION AND DISCOVERY, SUCH AS INSECTS (TOP LEFT), SAMPLING VESSELS, AND OTHER EQUIPMENT (TOP RIGHT AND BOTTOM LEFT). A PORTION OF THE CHICAGO FIELD MUSEUM'S COLLECTION OF FISH SPECIMENS, PRESERVED IN ALCOHOL (BOTTOM RIGHT).

TAXONOMISTS' INABILITY TO THRIVE RESEMBLES THE TALES OF WOE BEFALLING THE ENDANGERED SPECIES THEY ARE OFTEN CALLED UPON TO IDENTIFY. THANKS TO A LOSS OF HABITAT (ON AVERAGE, THE NUMBER OF UNIVERSITY POSITIONS RESERVED FOR TAXONOMISTS HALVES EVERY YEAR) AND A FAILURE TO REPRODUCE (NO ONE WANTS TO GET A PH.D. IN A DISCIPLINE THAT OFFERS VIRTUALLY NO EMPLOYMENT OPPORTUNITIES), TAXONOMISTS, AND ALL THEIR ART, ARE SLOWLY GOING EXTINCT.

Kingdom, concluded that, "Systematic biology is virtually dead." Scientists in the field have euphemistically dubbed this phenomenon the Taxonomic Impediment. The term encompasses many issues, but the most obvious to outsiders is the paltry, and dwindling, number of taxonomists.

This decline has been ongoing since the 1950s, and calls-to-arms have been sounding for at least that long. Meanwhile, even the last bastions of systematics research, non-university institutions like the Smithsonian's National Museum of Natural History (NMNH) and the United Kingdom's Museum of Natural History and Kew Royal Botanical Gardens, are cutting staff. According to the Integrated Taxonomic Information System (or ITIS), NMNH alone has lost 30 federal science positions over the last ten years—most of these in taxonomy. Currently in Britain, an estimated 1,400 professional conservators care for humanities' collections, while fewer than 20 safeguard natural history collections.

Taxonomists' inability to thrive resembles the tales of woe befalling the endangered species they are often called upon to identify. Thanks to a loss of habitat (on average, the number of university positions reserved for taxonomists halves every year) and a failure to reproduce (no one wants to get a Ph.D. in a discipline that offers virtually no employment opportunities), taxonomists, and all their art, are slowly going extinct.

A 1990 survey revealed that 63 percent of taxonomists were over 46 and only eight percent under 35, inspiring one wit to observe, "if the same demographic trends were found in a newly discovered lemur, specimens would be brought into a zoo and a captive breeding program initiated."

Hoffman, our reluctantly famous centipede specialist, agrees. "Here's a prediction," he offered,

"In 25 years, there will be no more museum or university research in taxonomy. Museums will become static dead tombs, sealed in nitrogen, with all taxonomy done by amateurs. We'll have come full circle to the 18th century, and society will no longer support professional taxonomy."

In a way, the slow erosion of human capital in taxonomy is merely a symptom of its unshakable association with the Victorian era in which it thrived. Pure, old-fashioned observational taxonomy is very much an antique science, perhaps the only one remaining that requires the same techniques and predispositions it demanded of Charles Darwin, who devoted eight years of his life to a four-volume study of barnacles.

"What we need is good old-fashioned 18th-century taxonomy," said Hoffman, dismissing the usefulness of advanced techniques of genetic sequence analysis when applied to previously unknown species. "That's the way knowledge progresses, we go in and do the trenchwork first. We can't skip over it. Someone's got to get the raw material into a form in which it can be cataloged and examined in detail."

It is the seemingly inescapable nature of preliminary work in taxonomy—the rude, repetitive struggle to simply get samples into collections and form hypotheses about the phylogenetic history of the novel ones—that escapes outside observers. The public and funding bodies alike tend to view taxonomy as boring, unimportant, and obsolete; the purview of graying dinosaurs pouring over dusty graveyards of disintegrating specimens (which, in a double irony, the field is fast becoming). Belying this, the NMNH adds almost half a million new specimens a year to its collection, according to the museum's Scott Miller, writing in the journal *Science*.

Nor do funding bodies grasp that taxonomic research cannot be experimental science as

Western civilization has come to worship it. Just this year a special committee on the crisis on taxonomy reported to the British Parliament that "many systematic biologists view the Research Councils' funding policies as contributing to the demise of systematic biology. In particular some systematic biologists felt that it was difficult to obtain this funding, primarily because the Research Councils do not understand that systematic research cannot always be framed as an hypothesis."

Taxonomists have countered this negative stereotyping by arguing that their field is an "enabling science," like star surveys and the Human Genome Project, both of which amass war chests far in excess of the scraps occasionally thrown to systematics researchers. The U.K. Research Council's rejoinder was that, unlike the enabling sciences previously cited, "alpha taxonomy [naming and describing species] is 'unusual' in that there are not users out there clamouring for significant increases in alpha taxonomy."

DELIVERABLES AND OTHER 21ST CENTURY CONCEITS

Ninety percent of described species have never been included in regional accounts of biotas, identification manuals, or modern monographs. Thus, 90 percent of the output of taxonomists is for the consumption of other taxonomists, and appears only in low-circulation journals hidden away in specialist libraries. Rarely has taxonomic research resulted in the kind of attractive (that is, accessible and useful) "deliverables" that grant-making bodies demand of applicants.

What's more, many of the "new" species that taxonomists describe are not after all new. Estimates of synonymy rates range as high as one-third of all new species described every year. (On average, every organism has been given two

SCIENTISTS HAVE NAMED ABOUT 80 PERCENT OF ALL THE PLANTS AND LARGE ANIMALS ON EARTH. UNFORTUNATELY, THESE TAXA REPRESENT ONLY A TINY FRACTION OF OUR HOME PLANET'S BIODIVERSITY.

“official” or synonymous names, and in the case of plants, the average climbs to five.)

In part, these issues are due to the headaches inherent in taxonomic work. Every reference to a species must acknowledge its first christening in print, no matter how ambiguous or unhelpful that centuries-old manuscript may be. On average, taxonomists spend one fifth of their time searching collections and literature. As their ranks thin and extant researchers are forced to shoulder new burdens, such as grant writing, teaching, curation, and administrative tasks, the amount of time available for research has shrunk to the same proportion, about 20 percent.

Worse, funding priorities, as well as the predispositions of taxonomists, have skewed the distribution of taxonomists across kingdoms. There is one plant taxonomist for every 366 species of plants, but only one viral taxonomist for every 5,000 viruses, and one mycologist for every 3,000 species of fungi. These trends hold true for every “attractive” and “unattractive” taxa; there are, for example, too many vertebrate

taxonomists and too few entomologists, relative, of course, to the size of the groups.

Finally, the legacy of an imperial past is that taxonomists aren't deployed where the species are. Only about six percent of the world's scientists live in those countries that house 80 percent of the Earth's biodiversity.

IN SEARCH OF A KILLER APP

None of this would matter if taxonomy were

merely the satisfaction of its practitioners' obsessive philatelist leanings. Indeed, few would be aware, and fewer still would care, that the accumulated knowledge of generations might stop being passed from scientists to students, if it weren't for the fact that conservation is so dependent on taxonomy.

For reasons of convenience, the species is the de facto unit of biodiversity. The species is also the de facto object of study in taxonomy. Biodiversity is what conscientious humans worldwide wish to conserve, and so to accomplish conservation we must study biodiversity—and that can't happen without taxonomy.

Out of necessity,

governments and non-governmental conservation organizations have begun to attempt the resurrection of taxonomy. They are demanding that the nearly comatose discipline accomplish what has rarely, if ever, been attempted—comprehensive surveys of whole ecosystems.

According to E.O. Wilson, “fewer than one percent of named species have been subject to the kind of careful biological studies needed to undergird ecology and conservation biology.”



JOHN DUMBACHER / CRC / NZP

"OUR DISCOVERY ILLUSTRATES THAT WE STILL DON'T KNOW EVERYTHING ABOUT THE EARTH'S SPECIES, EVEN IN AREAS THAT ARE VERY CLOSE TO THE UNITED STATES," SAYS S. BLAIR HEDGES OF PENN STATE UNIVERSITY, DISCOVERER OF THE WORLD'S SMALLEST LIZARD (*SPHAERODACTYLUS ARIASAE*) ON AN ISLAND OFF THE DOMINICAN REPUBLIC (BELOW).

If taxonomic records are, by analogy, the map of our DNA extracted by the Human Genome Project, then the interpretation of that data for assessments of biodiversity constitutes the Earth's proteome (the proteome comprises all of the protein molecules that are coded for by the genome). By adding this extra layer of description, taxonomists can help to inform the value judgments made by conservation policymakers.

TAXONOMY GOES BIG SCIENCE

It is with this imperative in mind that many international, national, sub-national, and one-person crusades have been launched. Collectively, these groups aim to bring to heel the staggering load of information present in the sum of all life on Earth. Their task is not unlike that faced by computer scientists at the European supercollider CERN, who must cogitate mightily in order to create a system that won't drown researchers in data.

The solution has so far been more grass roots than a great leap forward. Institutions all over the world are racing to make their data available in the only place where everyone can access it: the Internet. The Netherlands recently put all of their type specimens online, complete with digital pictures (a type specimen is the original example of an organism, to which all subsequent references must compare). Mexico has its CONABIO database; Australia has its ERIN system, exceptional because it integrates species with geographical data, allowing researchers to examine distributions and changes through time.

At the Smithsonian's National Museum of Natural History we have EMu—the Electronic Museum—a first attempt to put the world's largest collection of biological specimens online. This galaxy-eating leviathan will catalog the museum's 125 million items; however, funding limitations dictate that only 5.5 million will make it into the first iteration of the program. This information will be integrated in novel ways, for instance via live-mapping functions that place different kinds of data in a single geographic context.

The federal government runs its own racket, the U.S. Department of Agriculture's Integrated Taxonomic Information System (ITIS), a partnership between the Smithsonian, the U.S. Department of Agriculture, and other federal agencies, which recently paired with the Species 2000 database to form the Catalogue of Life. As

the name implies, the Catalogue of Life is a grandiose attempt to encompass the whole enchilada. By directly linking to nearly every species database on the web through common protocols and systems that extract data from natural-language sources, Species 2000 has succeeded in making available half the catalog of known species through a single portal. Many of the databases that it relies upon for data, such as Fishbase and Antbase, were begun and maintained by university professors, and exist solely on the good will of the organizations that shelter them.

Yet not even the Catalogue of Life can compare to the monumental (by virtue of technical savvy) All Species Foundation. Founded in 2000 by a consortium of San Francisco new-economy types (including Stewart Brand, founder of the online community known as the Well, and Kevin Kelley, a founder and now editor-at-large of *Wired* magazine), this organization has managed to forge a dozen scattered databases into a single Jovian implement.

The Foundation's goals are much bigger than simply building the biggest database of species that has ever existed. In its original charter, it aimed to do nothing less than catalog all Earth's species within a single generation (25 years) by using technology to accelerate the pace of new-species discovery. These technologies include three-dimensional digital imaging of specimens, artificial-intelligence systems for sorting data and comparing samples, and new uses of genetic sequence data.

Unfortunately, when the tech bubble burst, the All Species Foundation's hopes of riding the new-economy gravy train hit the skids. "We have been pleased with our ability to garner partners," said Julia Berger, Director of Special Projects at the All Species Foundation, in reference to their agreements with Species 2000 and the National Science Foundation (NSF). "But we've not been as pleased about the current economic environment in terms of ability to raise funds."

Despite being in a holding pattern, the All Species Foundation has managed, through its media savvy and sensational goals, to bring a modest amount of attention to the crisis in taxonomy. In this capacity, it has perhaps accomplished the most, because without fundamental changes in the way that all institutions supporting taxonomy do business, no amount of technology will save the field.

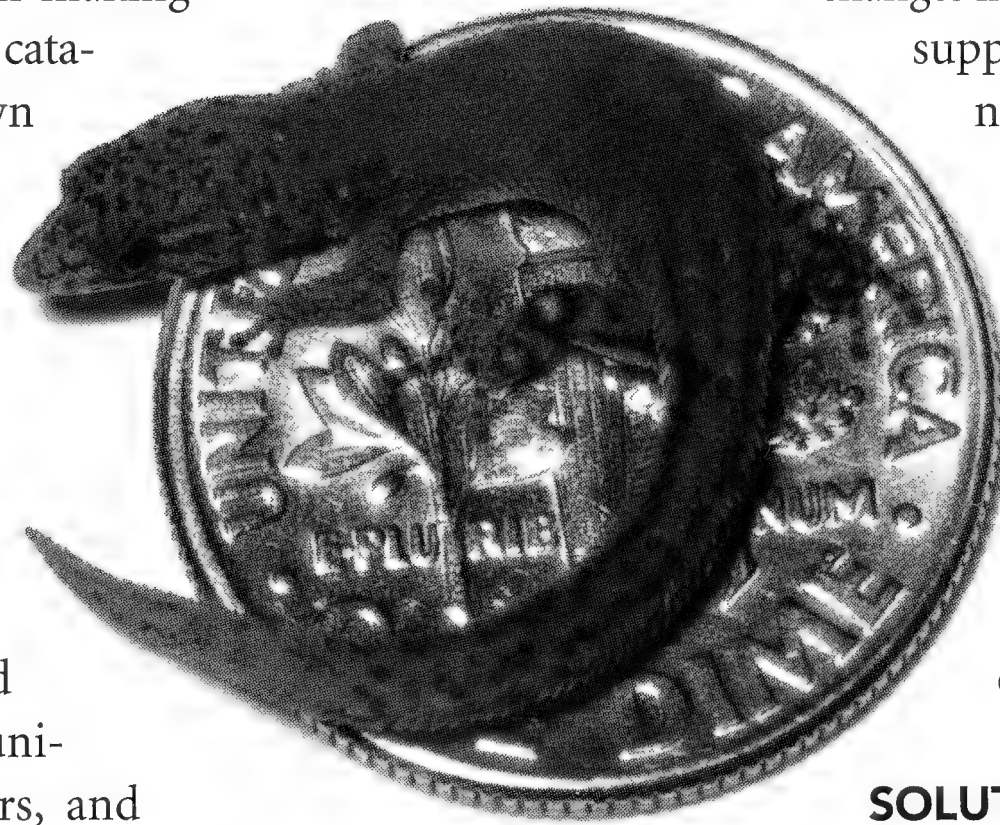
"There needs to be kind of a real sea change in institutions and academia to value taxonomy. It's only going to happen through education, and it's not going to happen overnight," said Berger.

SOLUTIONS

The National Science Foundation, long the only place to garner funding for projects with limited sex appeal, has not been deaf to the low drone of dissatisfaction issuing from those close to the field. Responding in the only substantive way possible (with money), the NSF set up the Partnerships in Enhancing Expertise in Taxonomy (PEET).

Matthew Hooe, a postdoctoral scientist at the University of Maine, is a typical PEET participant. He's everything the government wants to encourage, everything that's lacking in the current corpus of taxonomy: He's young, he's an expert in a little-studied group, and he's making his work accessible to the public and other researchers via computerized databases and the web. In conjunction with his advisor, Seth Tyler, he's also working on new techniques for examining the strange animals he calls a life's work: Interstitial meiobenthic fauna, or tiny organisms that make their home in between grains of sand on the bottoms of lakes, rivers, and oceans worldwide.

By infusing his worms with fluorescent dyes and illuminating them under laser light, Hooe has managed to generate impressions of an invisible universe littered with other-worldly beauty. "We've been able to correlate what we've found using morphological characteristics, with patterns of muscles, with molecular work we've done," said Hooe, who uses the images he generates to determine the relatedness of different meiobenthic nematodes. "We're essentially



© S. BLAIR HEDGES / PENN STATE UNIVERSITY

In the early 1980s, Terry Erwin of the Smithsonian's National Museum of Natural History estimated that 15 to 30 million species of insects alone might inhabit the Earth. This stunned the scientific community, given that only between one and two million insects have thus far been described, and Erwin challenged his colleagues to test his estimate with more data. Last year, a team of scientists, including Scott Miller of the Museum of Natural History and Yves Basset of the Smithsonian Tropical Research Institute, finally did so and concluded that the actual number may be between 3.7 and 5.9 million insects. Still many more than the number of insect species we know about.

It's not surprising that these two studies were the work of Smithsonian systematists or taxonomists—scientists who describe and classify the world's biodiversity. Some 70 Smithsonian scientists are systematists, and they work alongside about 40 systematists from other federal agencies and more than 40 research associates. But the human resources pale in comparison to the Smithsonian's biological resources. The Smithsonian holds some 83 million specimens of plants and animals, not to mention about 40 million fossils, and about half a million more are added each year. Scott Miller calls the collections and the staff that study them one of the Smithsonian's crown jewels.

Each year, too, Smithsonian biologists name many new species. In many cases, new species are identified when scientists pour through the collection's specimens in a particular group, say all the species in a single genus. Last year, for instance, this type of analysis of a genus of butterflies from South America yielded four new species and two new subspecies. In other cases, species are named when scientists find new species in the wild.

In 2001, W. John Kress, a Natural History Museum botanist, happened on an unusual-looking ginger flower in a display in Singapore. Later, the plant was collected in the wild in Thailand. Careful study by Kress and his colleagues, which included

growing the plant in the museum's greenhouse and comparing its DNA to related species, revealed that the ginger was not only a new species but a new genus in the family Zingiberaceae; they called it *Smithatris supraneeana*. They also predicted that a ginger in this genus might be found in similar habitats in Myanmar, a prediction borne out in the summer of 2002.

While new species, especially those of non-vertebrates and plants, can often be found even in well-studied areas, places like Myanmar, which was closed to foreign scientists for many years, offer particularly fertile grounds for adding to the roster of vertebrate species.

In 1994, Smithsonian's National Zoo scientists, led by Christen Wemmer at the Conservation and Research Center, began research in Myanmar, focusing on the endangered Eld's deer and since expanding to include Asian elephants. In 1997, Natural History Museum herpetologist George Zug and his colleagues joined this team to survey the country's amphibians. Thus far, they have collected specimens of about 50 species of frogs, one salamander, and two caecilians (little-known legless amphibians), and the scientists suspect that more than a dozen of them are previously undescribed species.

On the other side of the world in South America, Louise Emmons, a research associate at the Natural History Museum, has found several new species of rodent. Her most exciting find is a large tree rat that is both a new genus and a new species. Native to Peru, *Cuscomys ashaninka* as the rat was named, weighs about two pounds and has charming white stripes on its face.

More than 100 years ago, Joseph Henry, the first Secretary of the Smithsonian, said, "We have scarcely as yet read more than the title page and preface of the great volume of nature." This is as true today as it was then, but only for time and money constraints, not for want of trying.



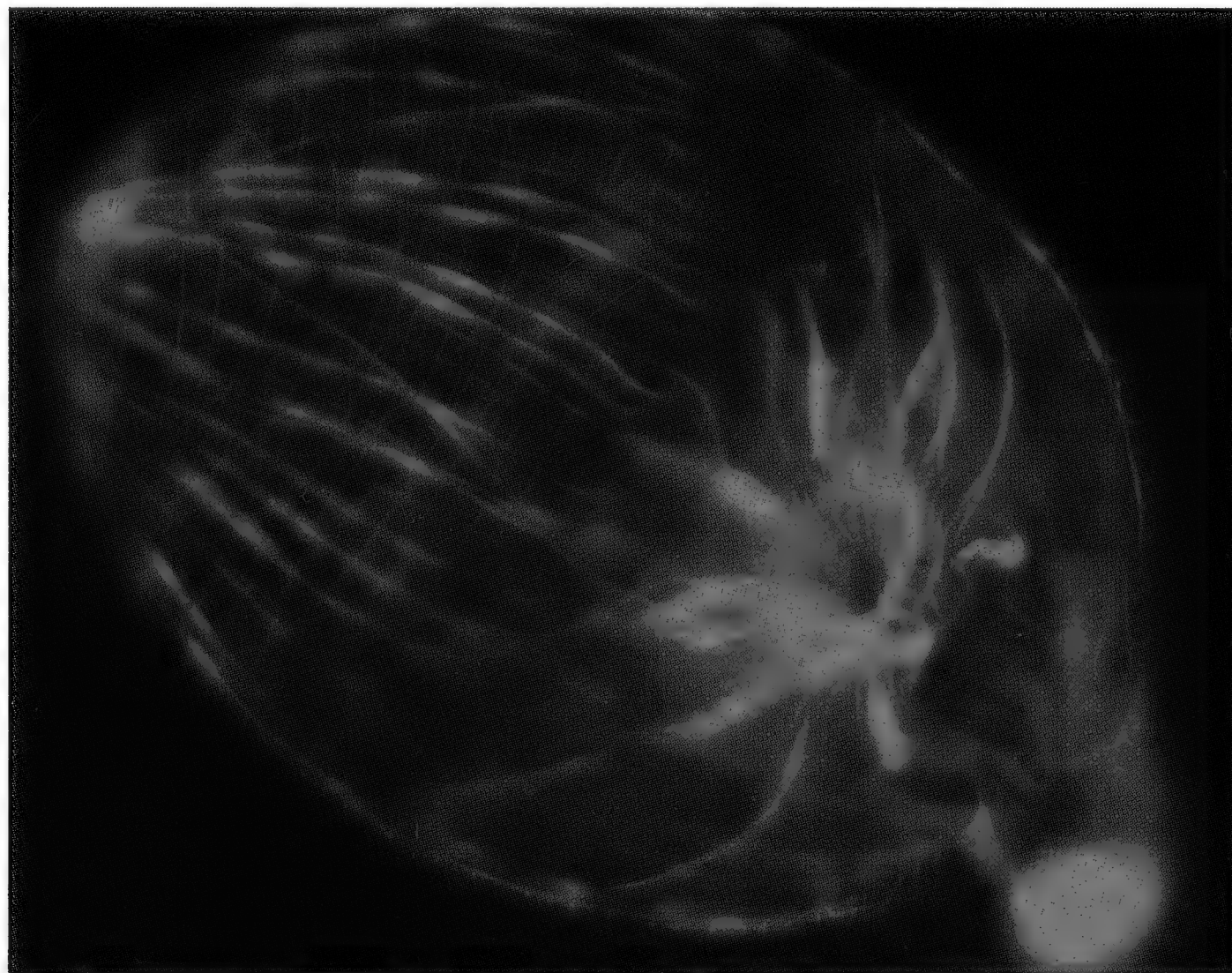
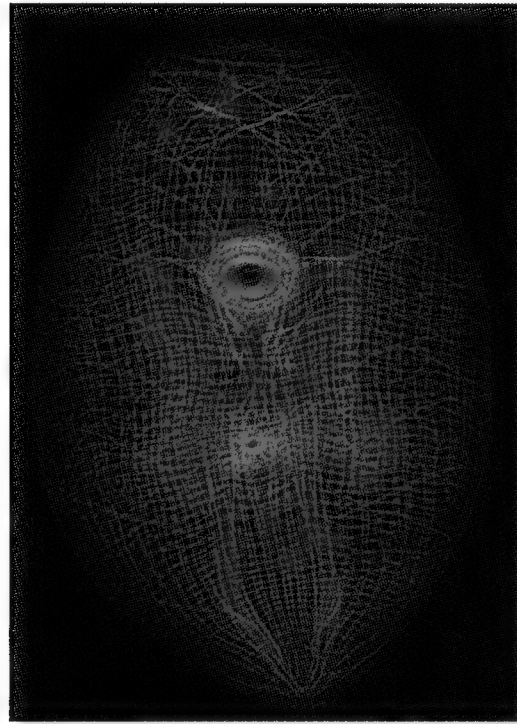
MICHAEL BORDELON / SMITHSONIAN INSTITUTION

SPECIES AT THE SMITHSONIAN

BY SUSAN LUMPKIN

SMITHATRIS MYANMARENSIS, AN ORCHID FROM MYANMAR.

ARCHIMONOTRESIS SP. (BELOW) IS A MEMBER OF THE INTERSTITIAL MEIOBENTHIC FAUNA. IT IS ONE OF THE TINY, LARGELY UNKNOWN, ORGANISMS THAT LIVE AQUATICALLY BETWEEN GRAINS OF SAND. RIGHT, JENSENSIA SP.



trying to concentrate on the old-school way of homology analysis.”

At the Smithsonian’s Museum of Natural History, Paula Depriest uses her PEET grant, one of several at the museum, to explore the phylogeny of an equally neglected branch of the tree of life. “Even among fungi, it’s a small group that studies lichens,” said Depriest. Her work on the Cladoniaceae, which includes the British soldier lichen, so called because their red caps resemble those of King George III’s troops, has taken her and her students to Paris and Uppsala, Sweden, in search of type specimens. In examining these fungus/algae symbiotes, they have used DNA sequencing technology, microsatellites, phylogenetic analysis, and statistical analyses of population and community-level data to reveal such subtleties as the lack of co-diversification of fungus and algae partners. “Fungi are picky about which algae they form a symbiosis with. They can shop around in the environment for whichever seems to work best.”

Despite the success, scientists have had in using PEET grants to generate monographs, disseminate taxonomic data via the world wide web, and train students, the program’s greatest weakness is that, as a limited-term grant, it ends.

“The PEET program is another example of federal shortsightedness,” said Hoffman. “Why get five years in taxonomy of some group if, afterwards, there’s no hope of a job?”

“It’s not about how many systematists we place in the next generation, but how we keep this field vital,” demurred Depriest. “Of the students we trained, maybe only one will ultimately have a job like mine. But we will have four or five students that think that systematics is an OK thing to do; who might advise their students to

do this.... Hopefully some will become grant funders.”

Either way, PEET remains a drop in the bucket, a few percent of all the money spent on taxonomy in North America. Increasingly, taxonomists and their parent institutions are coming to realize that if they want to carry on, they need new sources of funding and resources.

One creative solution, arrived at independently by both Patrons of Biodiversity (Biopat) in Germany and the Nature Discovery Fund in Canada, is to allow donors to have a new species named in their honor. Biopat has had more success, with nearly 80 patronages so far, including an orchid named for former Soviet Prime Minister Mikhail Gorbachev (*Maxillaria gorbatschowii*). By asking \$2,600 per patronage, Biopat has managed to raise nearly \$300,000. Even so, according to Joern Koehler, coordinator of Biota East Africa, “the real costs [of collecting and naming a new species] can be expected to be much higher than the amount provided by Biopat.”

The Nature Discovery Fund in Canada, founded through a collaboration of the Canadian Museum of Nature and author Margaret Atwood, has so far only accepted 15 donations of \$300 each. Caught in a funding catch-22, its member

scientists are so busy with their own work that they haven’t the extra time for working on the Nature Discovery Fund’s pro bono assignments.

Some argue that the real solution lies not in throwing more money at taxonomists, who require \$500,000 spread over ten years to become fully trained, but in training amateurs to take their place. Smithsonian scientists have taken to the idea, training and working with parataxonomists on projects in Papua New Guinea and in

Gabon. The Smithsonian’s Monitoring and Assessment of Biodiversity Program (MAB) in Gabon—a collaboration with Shell Gabon, Shell Foundation’s Sustainable Energy Program, and Gabonese counterparts—is assessing the biodiversity of this rich biological area of Western Africa, and the environmental impact of industrial activities in Gabon’s Gamba Complex. The complex holds Shell’s primary oil reserves in Gabon.

Smithsonian entomologists Scott Miller and Yves Basset had worked with parataxonomists before Gabon and, with some 12,000 insects coming to the complex’s processing center each week, it was decided that parataxonomists would be essential personnel. Parataxonomists work alongside taxonomists, collecting, sorting, preserving, and analyzing plant and animal specimens. Of the insects processed each week at Gabon, approximately 600 specimens had to be prepared and stored. They recruited eight enthusiasts for the study, selecting local assistants with no prior experience. Intensive tutoring and full immersion indoctrinated these assistants into the world of insects and taxonomy.

Parataxonomists are typically trained in the field and subsequently do field and laboratory



AN ARRANGEMENT OF RESEARCH TOOLS, BY ARTIST MARK DION; INSET, HE DEPICTS A PLOT TO BE ASSESSED FOR ORGANISMS.

MARK DION

work locally, staying in touch with the scientists after they have returned to their home institutions. Parataxonomists often have knowledge of the local plants and animals from years of experience within their environment, something scientists often rely on and upon which they hope to build their own knowledge. So far, the Gabon team has identified 280,000 insects, and prepared some 13,000 specimens.

In East Africa, the National Museum of Namibia came up with a unique way to digitize its enormous collection of insects. It sponsored a contest, called Insect@thon, across dozens of grade schools for the team that could enter in the most data on its collections. The kids, many of whom had never touched a computer, received training and computers for their schools, while the museum accomplished a digitization effort that would have been impossible otherwise.

THE FUTURE

A comprehensive, universally accessible catalogue of all extant taxonomic data may prove useful in ways now only dimly glimpsed. Already, scientists at the San Diego Supercomputing Center are linking taxonomic data with models of geographic distribution in order to predict where species are likely to live—even in areas that have never been sampled except by satellites and weather stations. Taxonomy's most starry-eyed boosters imagine a future in which the entire genome of a new species is sequenced in a single

afternoon, and systematics becomes a discipline dependent on comparing the DNA of organisms rather than their bodies and habits.

In such an era, the vast untapped trove of species Mother Earth has yet hidden from us will be probed via gene sequencers and databases, algorithms

and well-equipped amateurs. The same tools now used to probe the DNA of Linnaeus's *Simia satyrus* (chimpanzee) will be used to uncover an assortment of creatures large and small, many more wonderful and strange than even the most outrageous phantasmagoria from the bestiaries of de Almeda and Battel's age of discovery.

—Christopher Mims does freelance writing from his neurobiology lab bench at Emory University.

BOOKS, NATURALLY

Wilderness: Earth's Last Wild Places.
Russell A. Mittermeier, Cristina Goettsch
Mittermeier, Patricio Robles Gil, John
Pilgrim, Gustavo Fonseca, Thomas Brooks,
and William R. Konstant. 2003.
Conservation International,
Washington, D.C. 576 pp.,
490 color photographs, clothbound. \$75.

In a gorgeous book replete with stunning photographs of tribal people, wildlife, and wild lands, I kept returning to one: a haunting image of dunes in the Namib Desert that stretch into the distance seemingly without end. In the shadowy foreground, the sand is russet-colored but in the background it glows like hot coals in the sun. The only visible sign of life is a lone gemsbok trudging through the sand. It too is russet-colored, set off from the sand only by its long, backward-pointing horns and patch of white on its face, rump, and legs. This gemsbok clearly belongs to this harsh landscape, which otherwise appears to be a vast lifeless wasteland. But lonely as this gemsbok looks, he is surrounded by living things: 1,200 species of vascular plants, 262 birds, 67 other mammals, and nearly 100 reptiles and amphibians.

Wasteland is a standard dictionary definition of wilderness, and it's easy to see how people could gaze into such a desert and see nothing of use or value; any land not amenable to agriculture was deemed wasted. While that view prevails among some people in some places, more and more people around the world are beginning to recognize the immense value of wilderness, places not seen as wasted but rather as places not to waste. *Wilderness: Earth's Last Wild Places* shows us why.

Wilderness is part science, part art. The word wilderness not only means different things to

different people, it has been defined by many governments as well, although government definitions, including that in the U.S. Wilderness Act, may be as subjective as any one person's. Scientists at Conservation International (CI), who prepared this volume, first undertook to agree on objective criteria to select the wildernesses to be included. To qualify, an area must have 70 percent of its original vegetation intact, cover at least 10,000 square kilometers (3,861 square miles), and contain fewer than five people per square kilometer. Using these criteria, 31 areas were identified as wilderness. Among these are such obvious selections as Amazonia, Central Africa's Congo forests, and New Guinea, whose rainforests boast levels of biodiversity that dwarf those of other habitats. More surprising is the number of deserts—11 in all, including the Mojave, Sonora/Baja, Chihuahuan, and Colorado Plateau in or partly in the United States.

Six more areas did not meet one or two of the three criteria but were included for special reasons. The Appalachians and European mountains, for instance, meet only the size criterion but "... are symbolically very im-

*Away, away, from men and towns,
 To the wild wood and the downs,—
 To the silent wilderness,
 Where the soul need not repress
 Its music.*

—Percy Bysshe Shelley

portant as wilderness enclaves in the eastern U.S. and Europe, and have tremendous recreational, aesthetic, and spiritual value to these highly developed areas."

Each of the 37 wildernesses is described in a separate chapter, with an introduction on the area's history and sections on the area's biodiversity, flagship species, human cultures, threats, and conservation. Taken together, they provide an exceptional overview of

the natural world and our place in it. And the photographs are breathtaking, each one illuminating something essential about these special wild places and their inhabitants.

The most striking revelation of the book is the amount of wilderness left. These 37 areas are inhabited by a mere 2.4 percent of the human

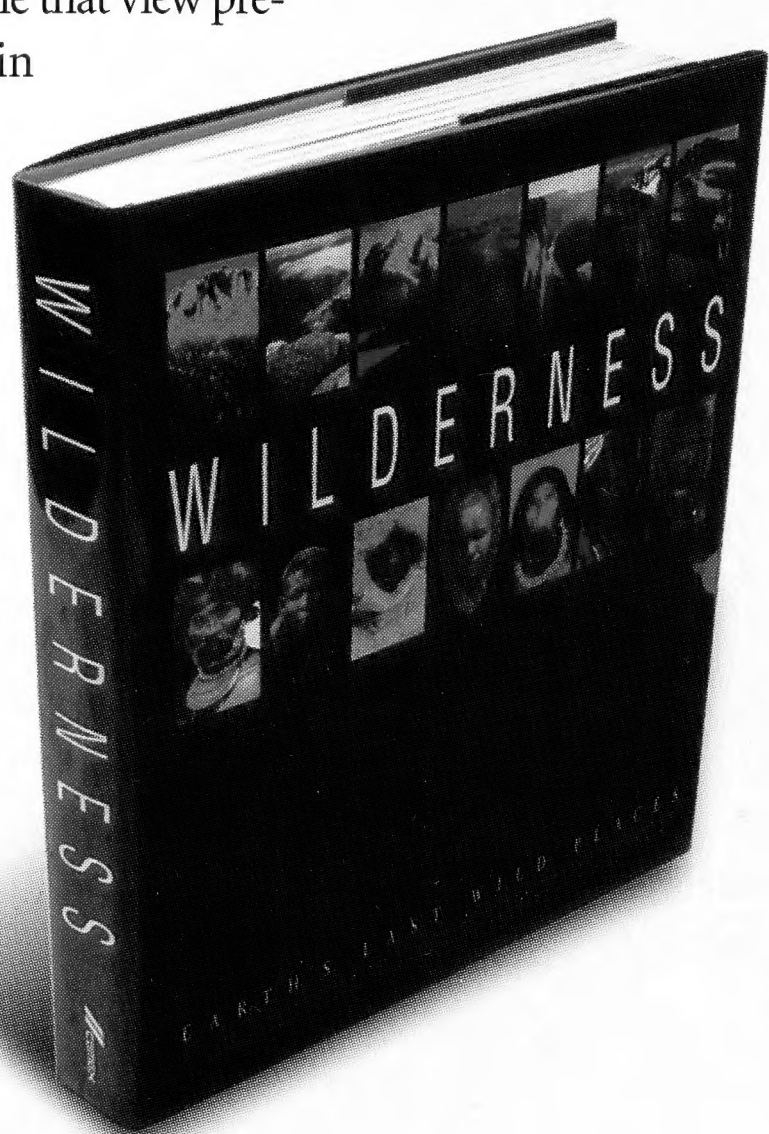
population but represent 46 percent of the Earth's land surface! What's more, collectively these areas form 84 percent of the original extent of wilderness, so the shrinkage has been relatively small. On the downside, however, only seven percent of the

total wilderness area is under some form of protection. Now is the time to act to protect much more. As the authors argue, "If these wilderness areas occupy more than half of Earth's land surface, yet have only about 2.4% of its human population, it should be possible to maintain them largely intact without deprivation to global society."

Indeed, saving these areas can only benefit global society, for reasons detailed in the text that range from their being storehouses of biodiversity and providing ecosystem services such as pollination and watershed protection to their value as sources of sustainable economic development and places where tribal people can continue to live traditional lifestyles. It is the photographs in this book, however, that make the most persuasive argument for protecting wilderness. These places, whether forests, savannas, deserts, or mountains, are irreplaceably beautiful, with the power to inspire grand dreams and flights of the imagination as nothing else can.

—Susan Lumpkin

To order *Wilderness* directly from Conservation International, go to http://www.conservation.org/xp/CIWEB/publications/books_papers/books/wilderness_index.xml. The \$75 cost includes UPS ground shipping within the United States.



BIO ALMANAC



The ecological destruction of Iraq under Saddam Hussein was widely ignored, overshadowed by concerns about weapons of mass destruction and human rights. With the fall of Baghdad, the scope of Iraq's environmental catastrophe is receiving more attention. At 20,000 square kilometers (7,000 square miles), Iraq's Mesopotamian Marsh was once the largest wetlands in the Middle East, but is now little more than a salty, desolate plain thanks to draining implemented in the mid-1990s by the regime. Hussein drained the marsh to repress the Shiite opposition, who used the marsh as a haven for their insurrection. In the process, he destroyed one of the most ecologically diverse wetlands in the world, an aquatic ecosystem comparable in importance to the Yangtze and Amazon River deltas.

With Saddam gone, plans are underway to restore the marsh. If successful, the project would be the largest wetlands restoration ever. Nearly 90 percent of the marsh has been destroyed, but several intact portions remain along the Iran-Iraq border, providing a model for the recovery. First, the parched landscape must be rehydrated by closing canals and drainage ditches that divert water from the Tigris and Euphrates Rivers. With water restored, animals and plants like the smooth-coated otter, jungle cat, and sacred ibis should recolonize their former haunts. Native marsh Arabs (ma'dam) can reestablish their homeland. Restoration may also benefit the rest of Iraq and other portions of the Middle East. By purchasing hydroelectricity from Turkey, Iraq as a whole gets more power and the increased flow down the Tigris from Turkey would benefit the marsh. Such an agreement may usher in new era of cooperation between the countries.

— from San Francisco Chronicle



JESSIE COHEN / NZP



The world's most biodiverse rainforest, Sumatra's Tesso Nilo, is threatened with destruction by 2005 if nothing is done to halt the pulp-mill industry that is currently consuming Indonesia's forests. According to the World Wildlife Fund (WWF), 64 percent of the Tesso Nilo Forest has already been converted to pulp and subsequently made into oil-palm plantations, seriously jeopardizing the region's diversity, including the threatened Asian elephant (*Elaphas maximus*) and the critically endangered Sumatran tiger (*Panthera tigris*). With the most plant species per acre ever recorded in any forest, the loss of the Tesso Nilo would be one of the most destructive ecological catastrophes in history.

Banks and export credit agencies from Great Britain, Germany, and the United States are largely financing this rainforest's destruction. Charged with encouraging overseas investment and development, such agencies supply loans to pulp mills, oil-palm plantations, and logging companies. In turn, copy paper, margarine, candy, and other products that rely on the Sumatran raw materials are produced for worldwide consumption. These are unsustainable industries, and threaten Sumatra's long-term economic and environmental health, in exchange for the short-term gains of industrialists and investors. The WWF has encouraged the Indonesian government to set aside the Tesso Nilo as a conservation area; the decision is pending.

—from WWF.org (The World Wildlife Fund)

»»MORE NEWS

Yellow crazy ants that have invaded Christmas Island in the Indian Ocean and exploded in numbers seriously threaten the endemic red land crab (*Gecarcoidea natalis*), an unusual crustacean that supports the island's unique rainforest

ecosystem by cleaning leaf litter off the forest floor. More than a third of the island's estimated 45 million red land crabs have been killed by the yellow crazy ants (*Anoplolepis gracilipes*), an invasive species named for their frenzied movements.

»»WHAT'S IN A NAME

Many would say that the term "bald" to describe the United States national bird is a bit of a misnomer considering the bald eagle has a dome of bright white feathers. The word "bald," however, is derived from the Middle English "balled," which meant "shining white," suggesting the eagle's description originally implied white feathers, rather than a lack of feathers. The bald eagle's scientific name, *Haliaeetus leucocephalus*, comes from Greek words that translate as "white-headed sea eagle." *Haliaeetus* comes from *halos* meaning "sea" and *aetos* meaning "eagle." *Leucocephalus* comes from *leukos*, which means "white" and *kephale*, which means "head." Interestingly, the eagle genus *Haliaeetus* is the same as the species name for another marine bird of prey, the osprey *Pandion haliaetus*. Notice, however, the different spellings. *Haliaeetus* with the double "e" is, in fact, the correct spelling. The osprey's *haliaetus* is the result of a mistake: The scientist who originally described the bird made an error translating the Greek alphabet to English. The name stuck, however, providing us with yet another interesting quirk of taxonomic etymology.

—compiled by Joshua Dietz, FONZ
Communications Intern

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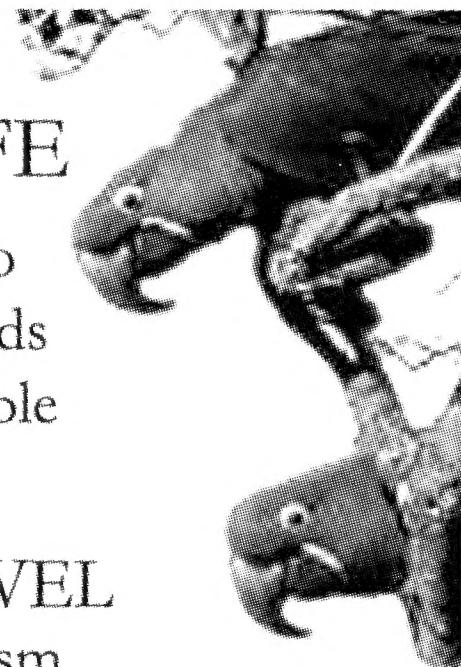
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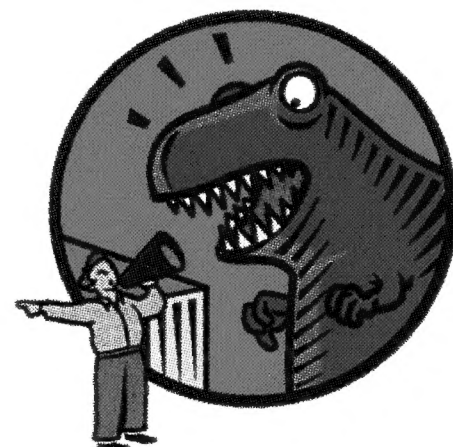
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